2016-1808

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

NFC TECHNOLOGY, LLC,

Appellant

v.

HTC CORPORATION, HTC AMERICA, INC.,

Appellees

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in IPR2014-01198

BRIEF FOR APPELLANT

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Dated: August 17, 2016

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

NFC Technology, LLC **v.** HTC Corporation, HTC America, Inc.

Case No. 16-1808

CERTIFICATE OF INTEREST

Counsel for the:
☐ (petitioner) ☒ (appellant) ☐ (respondent) ☐ (appellee) ☐ (amicus) ☐ (name of party)

NFC Technology, LLC

certifies the following (use "None" if applicable; use extra sheets if necessary):

1. Full Name of Party Represented by me	2. Name of Real Party in interest (Please only include any real party in interest NOT identified in Question 3) represented by me is:	3. Parent corporations and publicly held companies that own 10 % or more of stock in the party
NFC Technology, LLC	NFC Technology, LLC	FB Licensing, LLC
		France Brevets S.A.S.

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court (**and who have not or will not enter an appearance in this case**) are:

Sterne, Kessler, Goldstein & Fox P.L.L.C.: Amirali Sharifi

Apr 19, 2016
Date

/s/ Jon E. Wright
Signature of counsel

Please Note: All questions must be answered

Jon E. Wright
Printed name of counsel

cc: Counsel of Record

Reset Fields

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RULE 47.5 STATEMENT OF RELATED CASES

No other appeal in or from the same proceeding before the Patent Trial and Appeal Board was previously before this or any other appellate court. This Court's decision may directly affect, or be directly affected by, the related case styled *NFC Tech., LLC v. HTC Corp.*, No. 2:13-cv-1058 (E.D. Tex.) because it involves the same patent. The civil action is stayed pending final outcome of this appeal and co-pending, companion appeal No. 16-1809.

INTRODUCTION

The Board found claims 1-3 and 5 of NFCT's U.S. Patent No. 6,700,551 patent to be obvious over the Sears patent alone,[2] and to be obvious over Sears in view of the Nguyen patent.[3] The patent owner and appellant NFCT made the affirmative defense of antedating Sears because NFCT had evidence of an actual reduction to practice before Sears's earliest priority date. If that affirmative defense is successful, then Sears is not prior art to the '551 patent, and the obviousness grounds are moot.

In response to NFCT's affirmative defense, petitioner and appellee HTC challenged only whether there had been actual reduction to practice before Sears's priority date. But the Board never evaluated HTC's rebuttal argument in its final written decision. Instead, it *sua sponte* evaluated whether NFCT had proven conception. And finding that evidence insufficient, the Board then proceeded to raise a lack-of-inurement rebuttal argument on HTC's behalf because NFCT had contracted with an electronics fabrication company to make its prototype device. The Board exceed its authority when it stepped into petitioner HTC's shoes to make that argument. Moreover, in making that argument for HTC, the Board wrongly applied the detailed and highly formalistic interference standards for establishing priority between competing inventors, rather than the different evidentiary standards for antedating a reference that should apply here.

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[2] U.S. Patent No. 6,122,492 to Sears. Appx911-922

[3] U.S. Patent No. 5,399,925 to Nguyen, Appx923-930

This appeal thus raises important questions about (1) the Board's authority in an *inter partes* review to *sua sponte* make arguments on behalf of a petitioner in response to a patent owner's affirmative defense, and (2) the correct evidentiary standards for antedating a reference in the context of an *inter partes* review proceeding.

JURISDICTIONAL STATEMENT

At petitioner HTC's request, the Board conducted this *inter partes* review pursuant to 35 U.S.C. §311 *et seq*. and issued its final written decision under 35 U.S.C. §318(a) on February 3, 2016. Appx1. NFCT timely noticed its appeal on April 5, 2016. Appx631-636. This Court has jurisdiction over this appeal under 28 U.S.C. §1295(a)(4) and 35 U.S.C. §319.

STATEMENT OF THE ISSUES

1. Patent owner NFCT raised the affirmative defense of antedating the primary prior-art reference with an actual reduction to practice. Petitioner HTC responded with its own evidence and argument on that point. Did the Board exceed its authority in the final written decision when it stepped into petitioner HTC's shoes to evaluate NFCT's conception evidence, and then raised a lack-of-inurement argument that HTC itself never made?

2. In raising its conception/inurement rebuttal argument on behalf of petitioner HTC, did the Board err in evaluating NFCT's affirmative antedating defense under standards for establishing priority in an interference contest, rather than the different evidentiary standards used for antedating a prior-art reference?

3. If the Board did not exceed its authority (Issue 1), and NFCT was required to prove conception by the inventor (Issue 2), then did the Board err in determining that NFCT had not met its burden of production for conception, even though NFCT established at least a *prima facie* case that Charrat is the sole inventor, a point HTC did not challenge below and cannot challenge now.

STATEMENT OF THE CASE AND FACTS

This appeal is from *inter partes* review No. IPR2014-01198 of U.S. Patent No. 6,700,551. NFC Technology, LLC ("NFCT") owns the '551 patent and is the appellant here. The appellees are petitioners HTC Corp. and HTC America (collectively "HTC"). HTC challenged only independent claims 1-3 and 5 in this IPR. No other claims are at issue. The Board instituted trial on two separate grounds, which are summarized below:

Ground	References	Challenged Claims
35 U.S.C. § 103(a)	Sears	1-3 and 5
35 U.S.C. § 103(a)	Sears in view of Nguyen	1-3 and 5

We provide next an overview of the relevant facts, and Board's decision.

I. Overview of the invention and the prior art.

The '551 patent generally relates to "near-field communication" or "NFC" technology. NFC relies on the basic electromagnetic principal that a varying magnetic field can induce a current in a conductor. NFC devices can communicate over very short distances using such inductively coupled magnetic fields. The technology is used in "devices designed to exchange data with portable electronic objects comprising a contactless integrated circuit, such as contactless smart card readers, electronic label scanners, electronic badge scanners," and the like. Appx56, 1:14-18.

A. The claimed invention allows flexible modulation between two different NFC standards.

At the time of invention, there were two proposed communication standards for NFC devices—ISO 14443-2A and 14442-2/B—which the patent refers to as ISO/A and ISO/B. Appx56, 1:19-20. The primary difference between the standards is their respective modulation schemes. The term "modulation" refers to the changes induced in a signal so that the signal can convey information. The term "modulation depth" refers to the *amount* that a signal is changed—i.e., attenuated or modulated—to convey that information in an amplitude modulation scheme. *See* Appx3020-3025.

For instance, in amplitude modulation, a signal with no attenuation (i.e., a modulation depth of 0%) will convey one value (e.g., logical "1") to a receiver of that signal, and when that signal is subsequently attenuated or modulated to some other level, it will convey a different value (e.g., logical "0"). *Id*. The two standards described in the '551 patent use different "modulation depths" to convey information.

The ISO/A standard employs a modulation depth of 100%. This means that the signal varies from no attenuation when it's conveying a first value, to complete attenuation when conveying a second value. *Id*. In contrast, the ISO/B standard, employs a 10% modulation depth to convey information. *Id*. Thus, under the ISO/B standard, a signal will vary from no attenuation for a first value, and 10% attenuation (i.e., a signal having 90% of the amplitude of the original signal) for a second value. *Id.*

The '551 patent addresses an important problem that arises when there are two standards with different modulation schemes: namely, how to inexpensively and efficiently construct a device that is "multi-purpose and that can modulate the antenna signal with several modulation depths, particularly modulation depths of 10% and 100%." Appx56, 1:66-2:3. Before Mr. Charrat invented the subject matter of the ’551 patent, the only way for a single circuit to achieve multiple modulation depths was for the circuit to include extra (and more complex) modulation control circuitry. Appx3020, ¶ 22. Most didn’t bother. Instead, conventional inductive coupling data transmission devices worked only with a single transmission standard and a single modulation scheme. *Id.*

Mr. Charrat sought to design and build an NFC device capable of operating with multiple modulation depths and multiple coding schemes. Appx2964-2968, ¶¶ 23-34; Appx3020, ¶ 23. To that end, Mr. Charrat elegantly simplified the architecture required to realize multiple modulation schemes (*e.g.*, both 10% and 100%) using available, but previously unused, I/O ports on an off-the-shelf, commercially available, microcontroller—specifically, he chose to implement his idea with a PIC16C6X microprocessor from Microchip Technology Inc. Appx3020, ¶ 23; Appx57, 4:8-11. The ’551 patent achieves both the ISO/A and ISO/B modulation schemes by modulating the amplitude of a transmitted signal by controlling available binary ports and using them to power an antenna circuit. Appx3024-3025, ¶30.

B. The Sears patent is the primary reference on which the Board relies for unpatentability; the Nguyen patent is a secondary reference.

If it is prior art, the Sears patent only qualifies as such under 35 U.S.C. §102(e). Appx11. Its earliest filing date is February 8, 1999, Appx911, which is only 45 days prior to the March 25, 1999, priority date on the face of the ’551 patent, Appx50. Sears is the primary reference upon which HTC and the Board relied to finally determine that the challenged claims in the ’551 patent are unpatentable. Appx33-46.

The Nguyen patent relates to tristate inverter designs for use in integrated circuits. Appx927, 1:5-8. In its petition, HTC relied on Nguyen solely for its disclosure of these inverters, which it argued were akin to the claimed “binary ports that can be set to high impedance state.” Appx86-87. The Board similarly applied Nguyen. Appx44. Neither HTC nor the Board has alleged that Nguyen teaches any other claimed feature. Accordingly, if Sears were unavailable as prior art, Nguyen alone would not render the claims unpatentable.

II. The ’551 patent’s sole inventor Bruno Charrat, and his INSIDE team, tested a working prototype of the invention prior to Sear’s earliest priority date, thereby antedating Sears.

Bruno Charrat is the sole inventor of the method and apparatus set forth in the ’551 patent claims. At the time of invention, he worked for a company called INSIDE Technologies (later renamed INSIDE Contactless, and then renamed as INSIDE Secure—collectively “INSIDE”). Appx2958. He signed an oath and declaration as the sole inventor when he filed the U.S. Patent Application No. 09/962,889, which led to the ’551 patent. Appx696.

In the months leading up to first filing a patent application in France, Mr. Charrat configured and tested a prototype of his claimed invention no later than November of 1998, at least two months prior to Sears' effective prior art date. Appx696. In addition to the *prima facie* evidence that Mr. Charrat invented the subject matter of '551 patent present in the prosecution history, NFCT submitted additional evidence explaining the story of how Mr. Charrat and his INSIDE team actually reduced to practice the claimed subject matter. *See, e.g.*, Appx257-274.

A. Under Mr. Charrat's direction, the INSIDE team designed a solution, and had a working prototype fabricated by a local company.

The story of Mr. Charrat's invention has its origins in mid-1998, when engineers at INSIDE began work on what the company called M210H.[4] The M210H device was to be a low-cost reader/writer for use in near-field communication that improved on earlier devices developed by INSIDE. Appx2963-2964, ¶¶ 21-23. The M210H device would ideally need fewer components to reduce the overall cost, would ideally use commercially available off-the-shelf components, and most importantly would function with the two draft

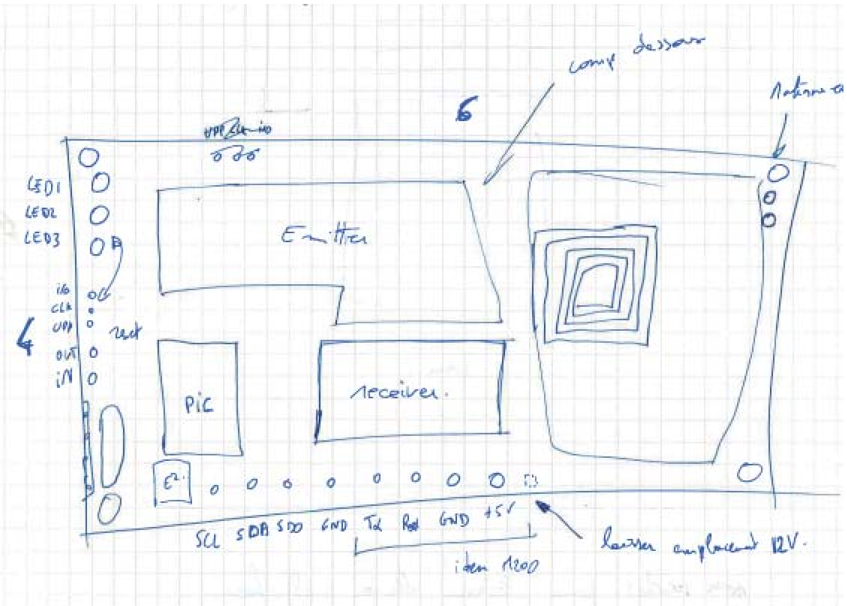
[4] All of the development of the M210H device occurred in Aix-en-Provence, in France, which is a WTO country. Appx2961. Accordingly, the inventor is entitled to the same priority rights "as if such invention had been made in the United States." 35 U.S.C. § 104(a)(2)(C) (pre-AIA).

standards for near-field communication that existed at the time: ISO14443-2/A and 14443-2/B ("ISO/A" and "ISO/B," respectively). *Id*.

Designing a device compatible with both of the ISO/A and ISO/B standards, yet having fewer components than the previous INSIDE devices, was no easy task. The ISO/A standard required the modulation of a transmission signal by 100%. Appx3004. In contrast, a device operating under the ISO/B standard must modulate its transmission signal by only 10% in order to comply with the standard. *See* Appx3008. In other words, the M210H device needed to support both 100% modulation and 10%, and be able to easily switch between them. *See* Appx2964, ¶ 23.

One way to achieve compatibility with both standards would have been to include a separate modulation circuit in the design of the M210H device to control the modulation depth. *See, e.g.* Appx56, 1:50-59. However, such a modulation circuit would require additional components, thereby running afoul of the directive that the M210H device have fewer components. Appx2965, ¶ 27. A different solution was needed.

Mr. Charrat provided that solution in September of 1998 when he conceived of using available, but unused, tri-state binary ports of an off-the-shelf microprocessor to achieve the variable modulation. Appx2965, ¶¶ 25-26. Specifically, by September 10, Mr. Charrat had fully worked out how to implement the design of the M210H using only available microprocessor ports (as opposed to a separate modulation circuit) to modulate the carrier signal. Appx2968, ¶ 34. Indeed, he had already begun the process of implementing the device as hand-drawn layouts in his notebook at that time show.

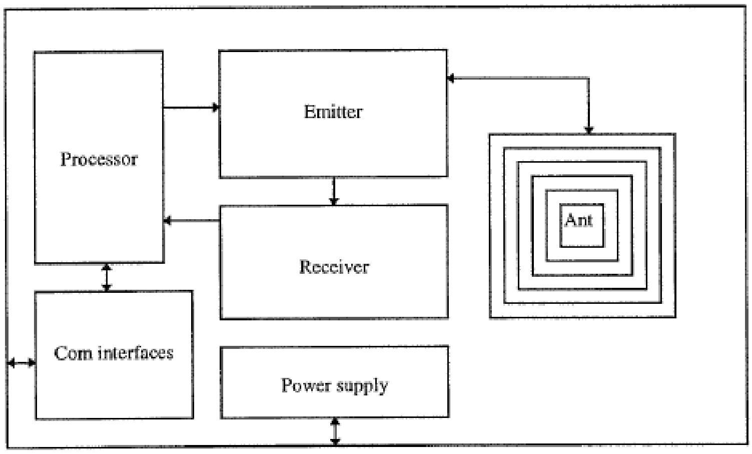


Excerpt from Appx2416 showing layout from Mr. Charrat's notebook

Mr. Charrat determined that he could directly connect the binary ports of a microprocessor—for example, the commercially available PIC16C63 processor—to the emitter and antenna, and then configure those microprocessor ports to modulate the amplitude of the carrier signal. Appx2965. By connecting and disconnecting some of the ports, Mr. Charrat reasoned that he might be able to achieve both 100% modulation and 10% modulation. As discussed below, he was ultimately correct. Appx2972, ¶ 42. Making it work, however, was by no means instantaneous.

Mr. Charrat began his initial efforts to design the M210H project on or before June 26, 1998, when he drafted a project data sheet memorializing the requirements of the M210H device. Appx2336 (crediting “BC” or Bruno Charrat with creating the initial version of the document on June 26, 1998). This initial data sheet laid out a number of the project requirements including the physical dimensions of the project, the supply voltage, the operating temperature, the power consumption, the operating frequency and signal bandwidth, etc. Appx2340. In addition, the document specified that the M210H device would need to be compatible with both the ISO/A and ISO/B standards. Appx2340; Appx2965-2966. In this document, Mr. Charrat also included a high-level block diagram of the M210H showing a processor directly connected to an emitter, which is itself connected to an antenna.

Fig. 2. ReadCrypt M210H Block Diagram



Excerpt from Appx2341 showing an early Block diagram of the M210H device

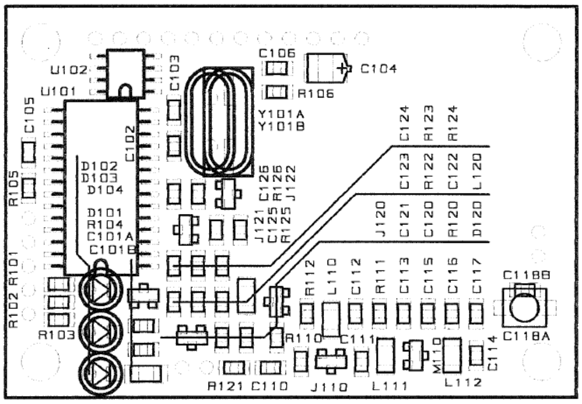
Shortly after drafting the initial data sheet for the M210H device, on June 30, 1998, Mr. Charrat and others generated a product development request (PDR). Like the data sheet, the PDR outlined general requirements for the M210H device, which included a requirement for compatibility with both the ISO/A and ISO/B standards. Appx2966-2967, ¶ 30; Appx2361. Another contemporaneous internal document from INSIDE also lays out the requirement that the M210H low-cost reader would need to “read ISO A & B chips.” Appx2966-2967, ¶ 31; Appx2368.

After the requirements for the M210H device had been determined, Mr. Charrat went to work designing a device that would meet those requirements. By August of 1998, Mr. Charrat had settled on using a PIC16C63 processor and had begun developing the necessary software code to implement the M210H device using the processor. Appx2967-2968, ¶¶ 32-33. For instance, Mr. Charrat needed to implement a Manchester coding scheme in order to practice the ISO/A standard. *Id*. His lab notebooks from the time show that he was working on software to implement Manchester coding. *Id*. By September 10, 1998, Mr. Charrat had fully conceived of the idea of using a PIC16C63 microprocessor to power and control the modulation of the antenna. Appx2968, ¶ 34.

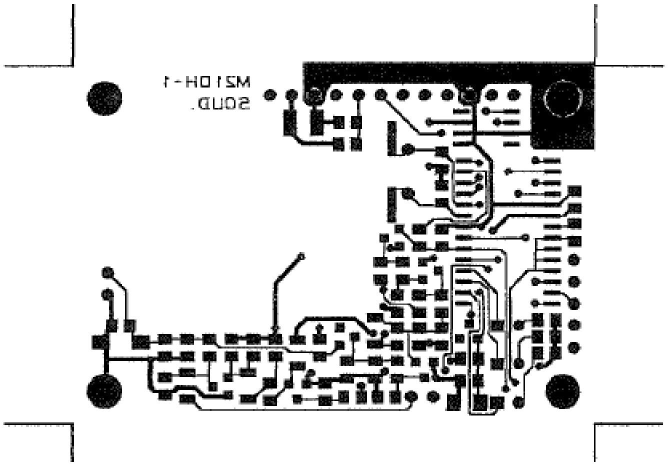
After creating the design of the M210H, Mr. Charrat worked with his development team at INSIDE to actually implement a working prototype. The team included Mr. Charrat, Francois Lepron, Alban de Moncuit, and Rodrigue Gil. Appx2960, ¶ 13. In September 1998, the M210H product was sufficiently well-developed to construct an actual physical prototype. Like many electronic design companies, INSIDE did not have the capability, internally, to actually fabricate the prototype—i.e., to fabricate a printed circuit board. Such construction requires highly specialized, expensive equipment. So INSIDE commissioned a local electronics fabrication company called Concept Electronique to generate printed circuit board (PCB) layouts for the prototype M210H device. Appx2969-2970, ¶¶ 36-38. Concept Electronique generated a PCB layout—i.e., the detailed routing based on INSIDE's request—and sent it to INSIDE for approval. Appx2972.

The layout generated by Concept Electronique shows a number of important features from the M210H design. For instance, U101 in the layout schematics is a PIC16C63 processor. Appx2969-2970, ¶ 37; Appx2445. The 4 pins on the of the

PIC processor (i.e., U101) are connected in much the same way as shown in FIG. 3 of the ’551 patent and are used for antenna modulation. Appx2969-2970, ¶ 37.


U102
U101
C105
C103
C106
C104
R106
Y101A
Y101B
C102
D102
D103
D104
D101
R104
C101A
C101B
R105
R101
R102
R103
C118B
C118A
R121 C110
J110
L111
L112

Excerpt from Appx2445—Top view of PCB Layout for prototype of M210H device



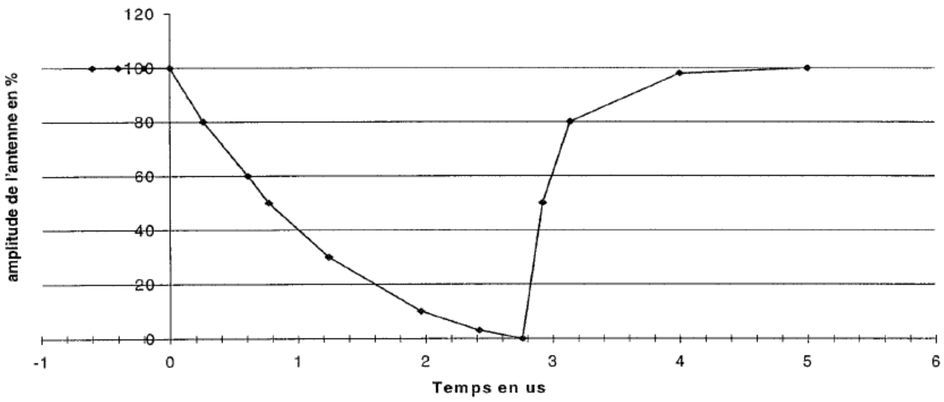
Excerpt from Appx2450—Bottom view of PCB Layout for prototype of M210H device

On September 10, 1998, Mr. Charrat approved, by facsimile, construction of the working prototype of the M210H device according to the PCB layout. Appx2970-2971, ¶ 38. INSIDE received a completed prototype device from Concept Electronique by November of 1998. Appx2972, ¶ 42.

B. The INSIDE team tested the prototype and found it to work for its intended purpose.

Upon receipt of the prototype M210H device in November of 1998, the INSIDE team began testing the device to verify that it would work for its intended purpose: modulating the carrier signal by both 100% and 10%. Appx2972-2974, ¶¶ 42-45. Specifically, the INSIDE team conducted tests of the prototype and Mr. de Moncuit authored a report detailing the results of these tests. Appx2825-2826. The tests show that the prototype M210H successfully modulated a carrier signal by both 10% and 100% using the ports of the PIC16C63 device. Appx2825-2826; Appx2972-2974, ¶¶ 42-45.

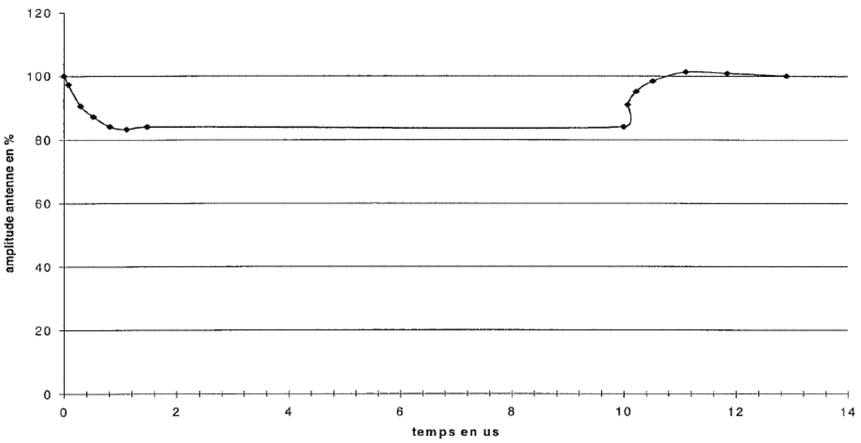
With respect to 100% modulation, the tests were conducted using four of the ports of the microcontroller to power the antenna and then subsequently setting the ports to 0V. Appx2825; Appx2972-2973, ¶ 43. The results of the testing, reproduced below, prove that the prototype achieved 100% modulation of the carrier signal. *Id.*



Excerpt from Appx2825—Test results showing 100% modulation.

These results were captured in an internal report, which shows a plot of the signal at the antenna versus time as the ports are set to “1,” then “0,” and then back to “1” again. Appx2972-2973, ¶ 43.

The INSIDE team also tested whether the prototype device was capable of achieving the 10% modulation required for the ISO/B standard. The test results show that these tests were successful. Appx2826; Appx2973-2974, ¶ 44. The prototype device was tested by setting 2 of the microprocessor ports to a high impedance, as indicated in the test results. *See,* Appx2826; Appx2972-2974, ¶¶ 43 and 44. These results are depicted in the graph, below.



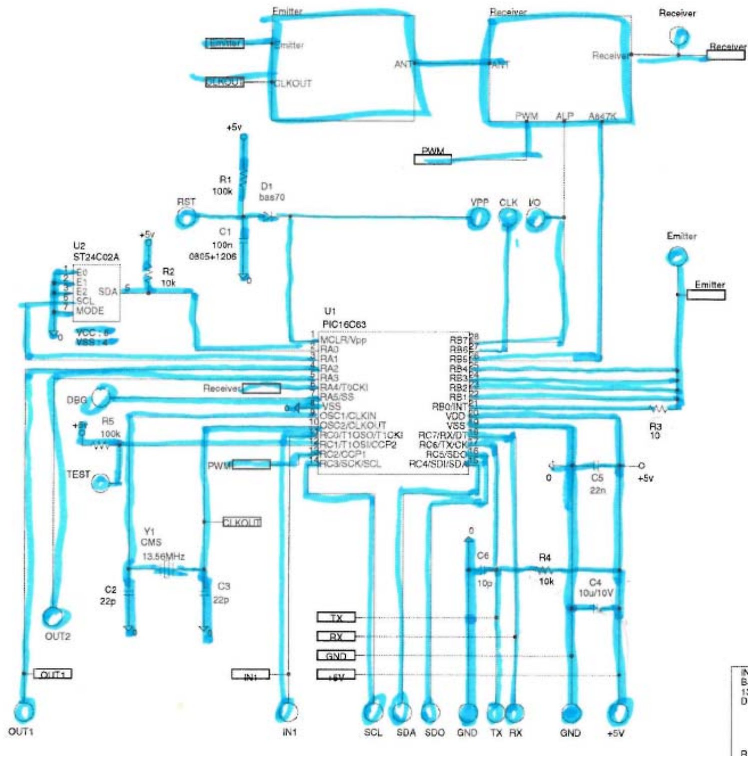
Excerpt from Appx2826—Test results showing 10% modulation of prototype device

As illustrated, the amplitude at the antenna begins at 100% and then rapidly falls to a lower level from about t=2 µs to 10 µs. This was caused by setting 2 of the ports of the microprocessor to high impedance. *Id.* At t=10µs, the 2 ports are again set to high impedance, and the amplitude of the signal at the antenna returns to 100% of its value.

Thus, Mr. de Moncuit's report indicates that the prototype M210H device was capable of both 100% modulation and 10% modulation. Appx2972, ¶42. Accordingly, Mr. Charrat and his team proved that the M210H device worked for its intended purpose of being compatible with both the ISO/A and ISO/B standards. Appx2974, ¶ 45.

In addition to testing the M210H prototype, the INSIDE team also verified that the prototype conformed to their designs. The INSIDE team had a simple and effective method of verifying that prototypes corresponded to their designs. To do this, they would compare a hard copy of a circuit diagram to the physical prototype and highlight the parts and connections they found on the prototype on the hard copy of the circuit schematic. Appx2974-2975, ¶¶ 46-47. If they found at the end that they had highlighted all of the wiring elements on the circuit schematic, then they could verify that the prototype had been constructed correctly. *Id.*

NFCT also put in evidence a highlighted wiring schematic for the M210H prototype. Appx2975, ¶ 47. Because all of the wires have been highlighted, the INSIDE team was able to verify that the M210H prototype corresponded to the actual design. *Id.* Importantly, the circuit schematic shows ports RB1-RB4 of the PIC16C63 processor connected directly to the emitter, which is consistent with the design of the M210H device and the claimed subject matter. *Id*.


Emitter
Receiver
ANT
CLKOUT
PWM
ALP
+5v
R1
100k
D1
bas70
RST
VPP
CLK
I/O
C1
100n
U2
ST24C02A
R2
10k
U1
PIC16C63
DBG
R5
100k
TEST
Y1
CMS
13.56MHz
C2
22p
C3
22p
R3
10
C5
22n
C6
10p
R4
10k
C4
10u/10V
TX
RX
GND
OUT2
OUT1
IN1
SCL
SDA
SDO
+5V

Excerpt from Appx2854—Highlighted (light blue) wiring schematic.

The combination of the highlighted wiring schematic and the testing report proves that the INSIDE team tested a physical prototype according to their designs and that the physical prototype worked for its intended purposes. Appx2974-2975, ¶¶ 45-47.

III. Petitioner HTC never challenged Mr. Charrat's conception and never mounted a lack-of-inurement rebuttal.

NFCT's patent owner response raised the affirmative defense that it could antedate the Sears reference and remove it as prior art. Appx257-282. In support, NFCT presented the full story of its invention of nearly two decades earlier, with as much evidence it could find in support. *Id*. Specifically, NFCT presented the full story of Mr. Charrat's invention, including additional evidence of conception, the diligent work of the INSIDE secure team at Mr. Charrat's direction, and evidence of an actual reduction in the form of a tested prototype device. *See generally* Sections II.A and B *supra*.

Though it had every opportunity to do so, HTC never challenged Mr. Charrat's conception. HTC asked that all original documents, including Mr. Charrat's laboratory notebooks, be made available to it for inspection at the depositions. NFCT complied with that request. HTC deposed Mr. Charrat and cross-examined him on his declaration. Appx1770-1862. HTC chose not to challenge Mr. Charrat on whether he was the sole inventor and it did not delve into conception.

In its reply to NFCT's affirmative defense, HTC chose to challenge only NFCT's actual reduction to practice. Appx448-466. It included a supplemental declaration from its expert Dr. Tentzeriz attacking only NFCT's actual reduction practice evidence. Appx1995-2050. Indeed, HTC expressly argued that "the Board should not and need not address any factors relating to conception or diligence." Appx466. Not having challenged Charrat's conception, HTC did not raise any argument that Concept Electronique's fabrication of the PCB prototype did not inure to Charrat's benefit.

NFCT then had a final opportunity address HTC's arguments and evidence. To address HTC's argument that NFCT failed to prove an actual reduction to practice, NFCT deposed HTC's expert on his supplemental declaration. NFCT then sought the Board's permission to file a sur-reply. Appx2312-2317. Even though antedating a reference is an affirmative defense, HTC opposed NFCT's request for sur-reply. Appx2318-2319. But if the Board were inclined to grant the request, then HTC expressly asked the Board for clarification and confirmation that NFCT would NOT be allowed to address issues related to conception or diligence, or be able to introduce any new evidence in that regard. Appx2325 ("So I think what Mr. Ai was saying is that the sur-reply should be limited to actual reduction to practice, which was the issue in the Patent Owner response and Petitioner reply.").

The Board agreed with NFCT that a sur-reply was warranted, and granted HTC's request to strictly limit NFCT's sur-reply to the actual reduction to practice issues that HTC raised in its reply. Appx482-483 ("The sur-reply shall be responsive only to the arguments in Petitioner's Reply addressing Patent Owner's arguments and citations to supporting evidence in the Patent Owner Response seeking to antedate Sears by showing prior*, actual reduction to practice*.") (emphasis in original). NFCT accordingly filed a sur-reply that addressed only the actual-reduction to practice issues raised by HTC. Appx514-521. The oral hearing followed. There, HTC confirmed again that the Board need not consider conception. Appx591 ("MR. BERNSTEIN: I think if the law says if they show an actual reduction to practice, I don't like to concede anything, Your Honor, but I think that would be sufficient if they had an actual proven corroborated actual reduction to practice, because I think that what the law says is that the conception date would be the same as the actual reduction date in that instance.").

IV. In its final decision, the Board *sua sponte* found that NFCT had not sufficiently proven Mr. Charrat's conception, and that INSIDE's actual reduction to practice therefore did not inure to Mr. Charrat's benefit.

HTC never challenged conception, never raised lack of inurement as a defense, and successfully precluded NFCT from even addressing conception in its sur-reply for its affirmative defense. Appx483. Yet the Board, *sua sponte*, in its final written decision, found that (A) that NFCT had not proven Mr. Charrat's conception, and (B) that any actual reduction to practice by Concept Electronique (or anyone else on Charrat's team) therefore could not inure to Mr. Charrat's benefit. Appx30. *And on that basis alone*, the Board ruled against NFCT's affirmative defense. Appx31. The Board did not evaluate NFCT's evidence or arguments regarding its actual reduction to practice, even though that was HTC's only rebuttal to NFCT's affirmative defense. See Appx30-31.

A. The Board concluded that NFCT's evidence was not sufficient to show that Mr. Charrat conceived the subject matter of the challenged claims.

The Board was "not *persuaded* that Patent Owner has shown that Mr. Charrat conceived the subject matter of the challenged claims." Appx26 (emphasis added). In support, the Board *sua sponte* undertook a detailed analysis of NFCT's evidence. It noted five alleged inconsistencies in the documents that NFCT used to corroborate Mr. Charrat's testimony. *See* Appx28-30.

First, the Board alleged that "there is no author named on the initial project data sheet… and only Mr. Charrat's testimony asserts that he is the author of the data sheet." Appx28. The Board's basis for this finding is unclear since the initial data sheet lists "BC," i.e., Bruno Charrat, as the author of the initial version. *See* Appx2336. There is no contrary evidence to suggest another author.

Second, the Board questioned the sufficiency of NFCT's evidence of conception, stating that "Patent Owner does not produce documents, other than Mr. Charrat's notebooks… which were prepared by Mr. Charrat and allegedly show the subject matter of the challenged claims." Appx28. Again, it is unclear how the Board made this finding. In addition to the notebook excerpts (Exhibits 2004-2006 in the IPR), NFCT offered a number of other exhibits that tend to corroborate Mr. Charrat's claim that he conceived the subject matter of the '551 patent, including Exs. 2001-2003 (Appx2335-2368) (INSIDE design documents), Ex. 2007

(Appx2442-2453) (PCB Layout), and Exs. 2015-2022 (Appx2865-2956) (corroborating evidence from a French patent attorney). *See* Appx259-266 and Appx270-274.

Third, the Board appears to question the veracity of the notebook excerpts submitted by NFCT, stating that “as Patent Owner acknowledged during the oral hearing, the notebooks are neither signed by Mr. Charrat nor witnessed by any other person.” Appx28. There is no contrary evidence to suggest that the notebook excerpts do not belong to Mr. Charrat. Indeed, NFCT introduced additional evidence from Michel Martin that the notebook excerpts are true and accurate copies of pages from the lab notebook that Mr. Charrat maintained during the development of the M210H device. Appx1969.

Fourth, the Board questions evidence that supports Mr. Charrat’s testimony that Concept Electronique was asked to fabricate a prototype device under Mr. Charrat’s direction because “Patent Owner does not produce evidence showing what the INSIDE team of engineers sent to Concept Electronique or the four (4) page document Concept Electronique attached to the facsimile cover sheet.” Appx29. Here, the Board refers to a fax Mr. Charrat sent giving Concept Electronique approval to begin manufacturing the prototype device. *See* Appx2788-2790.

Fifth, the Board notes an inconsistency in the designation between two exhibits—Ex. 2009 (Appx2788-2790) and Ex. 2012 (Appx2819-2853). The Board found that "[t]his lack of evidence, combined with the differing identifications of the prototype on Exhibit 2009 ('M210H') and on the post-fabrication test report, Exhibit 2012 ('M210H-2'), place in question what was fabricated and who provided the design used by the fabricators." Appx29.

Sixth, the Board observed that "the wiring diagram (Ex. 2013) that allegedly was used to confirm the accuracy of the fabrication of the Concept Electronique prototype, was labeled 'Revision: 3' and dated February 5, 1999, over two months after the fabrication date of the Concept Electronique prototype and after preparation of the test report." Appx29-30. But that document was still prior to Sears's February 8, 1999 completion date.

Based on these observations, the Board concluded that "[t]he gaps and inconsistencies in this evidence renders it insufficient corroborative evidence to demonstrate conception by Mr. Charrat or his direction of the fabrication of the prototype by Concept Electronique embodying subject matter conceived by Mr. Charrat." Appx30.

B. The Board concluded that the actions of the INSIDE team and Concept Electronique did not inure to Mr. Charrat's benefit, and it dismissed NFCT's affirmative defense of antedating Sears on that basis alone.

After finding, *sua sponte*, that NFCT did not meet its burden to show Charrat's conception, the Board again stepped into HTC's shoes and raised an "inurement" defense. That is, the Board introduced, for the first time, the question of whether the work of the INSIDE team and Concept Electronique to actually reduce the invention to practice "inured" to the benefit of the inventor Mr. Charrat. Appx11-31. The Board concluded that because NFCT had not proved that Mr. Charrat conceived the invention described by the '551 patent, Concept Electronique's work and INSIDE's work could not have inured to Charrat's benefit. Appx26. The Board therefore never evaluated whether Mr. Charrat and his INSIDE team had actually reduced the subject matter of the '551 patent to practice before Sears's priority date, Appx31, even though that was the only issue surrounding the NFCT's affirmative defense that the parties disputed during the trial.

SUMMARY OF THE ARGUMENT

This Court should reverse, or at a minimum remand, the Board's decision because the Board exceeded its authority, and moreover evaluated NFCT's evidence under the wrong standard.

First, under this Court's recent precedent in *Magnum Oil Tools*,[5] the Board cannot adopt arguments on behalf of a petitioner. Here, the Board exceeded its authority when it *sua sponte* reviewed NFCT's conception evidence and raised a conception/lack-of-inurement argument on HTC's behalf, even though HTC itself never challenged Mr. Charrat's conception or raised an "inurement" defense. In fact, HTC affirmatively argued that the Board "should not and need not address any factors relating to conception or diligence." Appx20-21, Appx466. The Board's actions deprived NFCT of the opportunity to respond to any critique of its conception evidence, or to argue that its evidence was, in fact, sufficient under the correct legal and evidentiary standards for antedating a prior-art reference. Had HTC properly raised this defense in its reply, NFCT would have had the opportunity to make those arguments in its sur-reply. And the Board could have evaluated those arguments in its final written decision having first heard from both parties.

Second, while exceeding its authority the Board also misapplied the law. The Board erroneously relied on an interference standard in evaluating NFCT's conception evidence, rather than the proper standards for antedating a reference. Interferences focus on *who* invented first. Interference law therefore applies a detailed and highly formalistic evidentiary standard for establishing priority between competing inventors. The evidentiary standards for antedating a reference are different. They appropriately focus on *when* the invention occurred and not *who* invented. That is why all NFCT needed to prove was an actual reduction to practice by Mr. Charrat and his team at INSIDE, before Sears's earliest priority date. Indeed, Mr. Charrat's filing of an oath and declaration with his U.S. Patent Application, in the absence of any challenge or evidence to the contrary, is *prima facie* evidence that he is the sole inventor.

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[5] *In re Magnum Oil Tools Int'l*, --- F.3d ---, 2016 WL 3974202 (Fed. Cir. Jul. 25, 2016)

Finally, the Board erred in its evaluation of whether NFCT met its burden of production for its affirmative antedating defense. Under the proper burden of production, NFCT had to raise only a *prima facie* case with respect to its antedating argument for it to move forward with its affirmative defense. NFCT easily met that burden with respect to conception, and HTC did not (and cannot now) challenge that evidence. NFCT also met its burden of production with at least *prima facie* evidence of an actual reduction to practice prior to Sears's earliest priority date. The Board legally flawed analysis exceeded its authority and improperly foreclosed it from even reaching the only issue the parties actually contested with respect to NFCT's affirmative defense—whether NFCT actually reduced to practice an embodiment of the invention prior to Sears's earliest priority date.

STANDARD OF REVIEW

This Court reviews "the Board's compliance with governing legal standards de novo." *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013). This court reviews the Board's legal conclusions *de novo*, and its underlying factual findings for substantial evidence. *In re Gartside*, 203 F.3d 1305, 1313 (Fed. Cir. 2000). With respect to issues of invention, "[p]riority of invention and its constituent issues of conception and reduction to practice are questions of law predicated on subsidiary factual findings." *Singh v. Brake*, 317 F.3d 1334, 1340 (Fed. Cir. 2003).

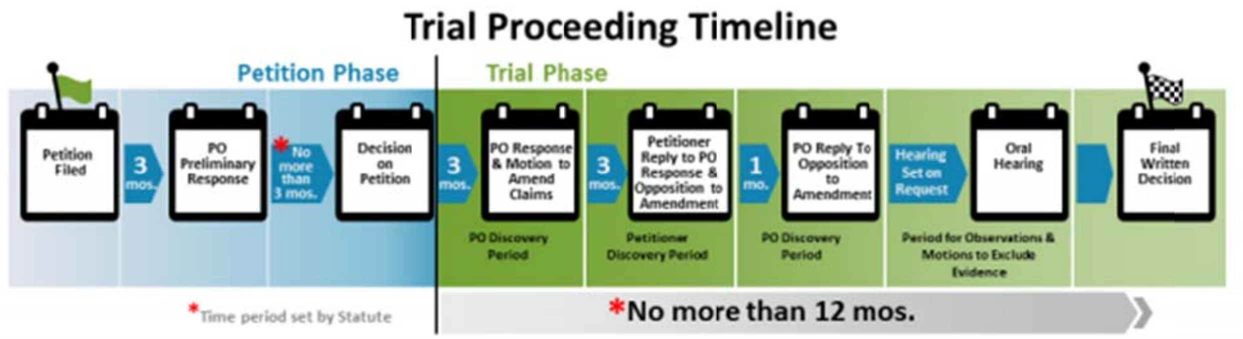
ARGUMENT

I. The Board exceeded its authority when it *sua sponte* stepped into HTC's shoes and established for HTC a conception/inurement rebuttal to NFCT's affirmative defense of antedating Sears.

The Board must base its decisions on arguments actually advanced by the parties. *See Magnum Oil Tools*, 2016 WL 3974202 at *10. Here, the parties and the Board followed well-settled procedures for conducting an IPR trial. But the Board exceeded its authority in its final written decision when it raised, addressed, and decided this case on a theory never presented by petitioner HTC, and thus never argued by the parties. The Board's decision to step into HTC's shoes deprived NFCT of its ability to both respond to the purported evidentiary gaps and to challenge the legal standards undergirding the Board's decision on NFCT's affirmative defense.

A. The parties followed well-settled trial procedures in setting forth their respective evidence and arguments.

The procedures for carrying out an IPR trial are by now well-settled. So are the respective burdens borne by the parties. The following graphic from the Office's website[6] outlines the basic procedure:


Trial Proceeding Timeline
Petition Phase
Trial Phase
Petition Filed
3 mos.
PO Preliminary Response
*No more than 3 mos.
Decision on Petition
3 mos.
PO Response & Motion to Amend Claims
3 mos.
Petitioner Reply to PO Response & Opposition to Amendment
1 mo.
PO Reply To Opposition to Amendment
Hearing Set on Request
Oral Hearing
Final Written Decision
PO Discovery Period
Petitioner Discovery Period
PO Discovery Period
Period for Observations & Motions to Exclude Evidence
*Time period set by Statute
*No more than 12 mos.

In IPR proceedings, the petitioner bears the burden of *persuasion* to prove unpatentability, 35 U.S.C. § 316(e), and "that burden never shifts to the patentee," *Magnum Oil Tools*, 2016 WL 3974202 at *6. Upon initiation, the trial phase begins with the patent owner's discovery period and response. 37 C.F.R. § 42.120. Here, the patentee NFCT chose the affirmative defense of antedating the primary Sears reference—that is, NFCT alleged that the Sears patent is not prior art because NFCT could show invention prior to Sears's earliest priority date.[7]

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[6] http://www.uspto.gov/patents-application-process/patent-trial-and-appeal-board/trials

[7] NFCT also argued the merits of the obviousness grounds, but does not appeal the Board's decision in that regard here.

The well-established law for antedating a reference, which we discuss in more detail below, is set forth 37 C.F.R. § 1.131. The rule requires an oath or declaration "showing of facts … in character and weight, as to establish [1] reduction to practice prior to the effective date of the reference, or [2] conception of the invention prior to the effective date of the reference coupled with due diligence from prior to said date to a subsequent reduction to practice or to the filing of the application." 37 C.F.R. § 1.131(b). NFCT chose the first option, which required only an actual reduction to practice prior to Sears's earliest priority date.

In electing this affirmative defense, the burden of *production* shifted to NFCT when it filed its patent owner response at the start of the trial phase. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). The patentee NFCT thus put forth in its response the evidence and argument supporting its affirmative defense, including a declaration from the sole inventor, Mr. Charrat, along with other corroborating declarations. *See supra* Section II.A-B. In an IPR proceeding, there is no rule or procedural mechanism that allows the Board to review, mid-trial, a patent owner's affirmative defense to determine whether it satisfies the initial burden of production. The discovery window simply shifts to the petitioner.

So, once NFCT presented its evidence for antedating Sears, based on an actual reduction to practice, the burden shifted to HTC to respond in its petitioner's reply. The burden of production thus presumptively shifted to the petitioner HTC to respond to NFCT's affirmative defense. HTC used its discovery period to depose all of NFCT's witnesses, including the inventor Mr. Charrat. HTC then filed its reply to NFCT's patent owner response. Appx438-469. It thus fell to HTC to again *persuade* the Board that Sears qualifies as prior art, and that the challenged claims are unpatentable over Sears. With respect to NFCT's affirmative defense, HTC's reply challenged only NFCT's actual reduction to practice argument and evidence. *See supra* Section III; Appx466. Indeed, HTC expressly (and correctly) argued that the Board need not consider issues such as conception and diligence. Appx466. HTC therefore did not challenge NFCT's conception evidence, and it did not raise an inurement defense.

Though a patent owner is normally not entitled to a sur-reply, NFCT requested one since it was entitled to have the last word with respect to its affirmative defense. *See Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1081 (Fed. Cir. 2015). The Board granted NFCT's request over HTC's objections, but expressly limited the sur-reply to a response "to the arguments in Petitioner's Reply addressing Patent Owner's arguments and citations to supporting evidence in the Patent Owner Response seeking to antedate Sears by showing prior, *actual reduction to practice*." Appx483 (emphasis in original). NFCT filed its sur-reply addressing only that issue, Appx514-521, and the trial proceeded to the oral hearing. There, the parties again made it clear to the Board that the only disputed issue with respect to NFCT's affirmative defense was when and whether NFCT had proven an actual reduction to practice prior to Sears's priority date. *See supra* Section III.

The parties and the Board conducted the trial portion of the IPR in accordance with settled procedures following the now well-established burdens of persuasion and production.

B. The Board exceeded its authority when it established and relied on an argument that HTC never made to reject NFCT's affirmative defense .

The Board exceeded its authority when it examined NFCT's conception evidence and then raised a lack-of-inurement argument on HTC's behalf, even though HTC never even challenged Mr. Charrat's conception.

This Court explained in *Magnum Oil Tools* that the Board is not "free to adopt arguments on behalf of petitioners that could have been, but were not, raised by the petitioner during an IPR." *Magnum Oil Tools*, 2016 WL 3974202 at *10. Such checks on the Board's authority are not new. *See e.g.*, *In re Kumar*, 418 F.3d 1361, 1369 (Fed. Cir. 2005) ("After the Board [*sua sponte*] adduced its calculations of particle size and distribution, Kumar was entitled to offer evidence in rebuttal."). And they are equally compelling in contested IPR proceedings where "the burden of persuasion is on the petitioner to prove unpatentability by a preponderance of the evidence… and that burden never shifts to the patentee." *Magnum Oil Tools*, 2016 WL 3974202 at *6. Nor do the burdens ever shift to the Board itself.

In *Magnum Oil Tools*, the issue was whether the Board could make obviousness arguments on behalf of a petitioner because the arguments "could have been included in a properly-drafted petition." *Id*. This Court said the Board could not make such arguments. *Id.* at *10. Here, the procedural posture is slightly different. The Board stepped into the petitioner HTC's shoes not to make an original argument of unpatentability, but rather in response to NFCT's affirmative defense. But this different procedural posture does not impact the underlying rationale for the Court's decision in *Magnum Oil Tools*—basic fairness and the ability to respond. *Id.* ("[T]he Board must base its decision on arguments that were advanced by a party, and to which the opposing party was given a chance to respond."); *accord*, *Dell Inc. v. Acceleron, LLC*, 818 F.3d 1293, 1301 (Fed. Cir. 2016) (vacating the Board's cancelation because "the Board denied Acceleron notice and a fair opportunity to respond to th[e] basis of cancellation.").

The Board's action here deprived NFCT of the opportunity to respond to any critique of its conception evidence. It also deprived NFCT of arguing that its evidence was, in fact, sufficient under the correct legal and evidentiary standards for antedating a prior-art reference. Had petitioner HTC properly raised the

Board's conception/inurement defense in its reply, NFCT would have had the opportunity to make those arguments in its sur-reply, and the Board could have resolved those legal and evidentiary issues *after* having heard from the parties. Instead, NFCT is forced to make those arguments for the first time here, before this Court. *See* Section II *infra*.

This Court should extend to a petitioner's rebuttal of affirmative defenses the same guidance it gave the Board in *Magnum Oil Tools* with respect to a petitioner's original arguments—namely, that that the Board's "authority is not so broad that it allows the PTO to raise, address, and decide unpatentability theories never presented by the petitioner and not supported by record evidence," *id*. at *10, because that is effectively what the Board did here.

II. The Board improperly evaluated NFCT's evidence under interference standards, rather than the standards for antedating a reference.

Not only did the Board exceed its authority, it also misapplied the law by erroneously relying on interference standards in evaluating NFCT's evidence. It should have relied on the well-established standards for antedating a reference. The Board's legally flawed analysis improperly foreclosed it from reaching the only issue the parties actually contested with respect to NFCT's affirmative defense—whether NFCT actually reduced to practice an embodiment of the invention prior to Sears's earliest priority date.

A. The evidentiary standards for evaluating prior invention in an interference are more stringent than the standards applied for antedating a prior-art reference.

The evidentiary requirements for establishing priority in an interference proceeding are strict. Interferences are governed by 35 U.S.C. §§ 102(g) and 135 and a detailed set of rules for contested cases set forth in 37 C.F.R. §§ 41.100-208 (pre-AIA). These contested priority proceedings seek primarily to resolve *who* invented first when two inventors claim the same invention. As a result, interference law traditionally requires a "detailed and highly formalistic corroboration of the inventor's work [to] establish priority between competing inventors." *Loral Fairchild Corp. v. Matsushita Elec.*, 266 F.3d 1358, 1366 (Fed. Cir. 2001) (J. Newman concurring).

The evidentiary standards for antedating a prior-art reference are different. The well-established law is set forth in Office Rule 131, which allows an inventor to submit an affidavit or declaration to "establish invention of the subject matter of the rejected claim prior to the effective date of the reference … on which the rejection is based." 37 C.F.R. § 1.131(a) (pre-AIA). Antedating focuses not on *who* invented, but rather on *when* the invention occurred. Indeed, when an issued patent is under reexamination, Rule 131(a) allows "the *owner* of the patent under reexamination" to submit the declaration. *Id*. (emphasis added). So it need not even be the inventor making the declaration.

The evidentiary standards for antedating a prior-art reference are consistent with that theme. Specifically, Rule 131(b) sets forth two ways to antedate a prior-art reference – "The showing of facts for an oath or declaration under paragraph (a) of this section shall be such, in character and weight, as to [1] establish reduction to practice prior to the effective date of the reference, or [2] conception of the invention prior to the effective date of the reference coupled with due diligence from prior to said date to a subsequent reduction to practice or to the filing of the application." 37 C.F.R. § 1.131(b). That first option under Rule 131(b) says nothing about conception. This is not surprising considering that there is typically no priority dispute when using Rule 131. *See generally*, *In re Eickmeyer*, 602 F.2d 974, 979-80 (C.C.P.A. 1979) (explaining differences between antedating a reference and provoking an interference). Nor was there any priority dispute here.

To be sure, there are long-recognized parallels between interference law and antedating law. But "[t]he parallel to interference practice found in Rule 131(b) should be recognized as one of convenience rather than of necessity." *In re Moore*, 444 F.2d 572, 580 (C.C.P.A. 1971). As this Court's predecessor cogently explained, "[t]he purpose of filing a 131 affidavit is *not* to demonstrate prior invention *per se*, but merely to antedate the effective date of the reference. Although the test for sufficiency of an affidavit under Rule 131(b) parallels that for determining priority of invention in an interference under 35 U.S.C. §102(g), it does not follow that Rule 131 practice is controlled by interference law." *In re Eickmeyer*, 602 F.2d 974, 978-79 (C.C.P.A. 1979) (internal citation omitted; emphasis in original); *accord In re Moore*, 444 F.2d 572, 580 (C.C.P.A. 1971) ("[T]he 'conception' and 'reduction to practice' which must be established [to antedate a reference] need not be the same as what is required in the 'interference' sense of those terms.")

It is thus well-established that "[t]he evidentiary standard for antedating a reference is not the same as the PTO requirement for establishing priority in an interference contest." *Loral Fairchild Corp.*, 266 F.3d at 1366 (J. Newman concurring).

B. The Board erred when it applied interference law standards instead of the correct standards for antedating a prior-art reference.

There are at least four reasons why the Board erred when it relied on interference standards to craft a conception/inurement defense on behalf of HTC.

First, there was no need for the Board to consider Mr. Charrat's conception at all. All NFCT needed to prevail under Rule 131(b) was a corroborated actual reduction to practice by Mr. Charrat and his team at INSIDE, before Sears's earliest priority date. Rule 131(b), on its face, does not require proof of conception. NFCT included evidence of Charrat's conception as part of its "story of the invention," but it did not need that evidence because it had proof of an actual reduction to practice. *See Purdue Pharma L.P. v. Boehringer Ingelheim, GMBH*, 237 F.3d 1359, 1366 (Fed. Cir. 2001) ("Where an inventor is unable to establish conception until he has reduced the invention to practice through a successful experiment, simultaneous conception and reduction to practice occur."). HTC itself conceded this. Appx591 ("MR. BERNSTEIN: I think if the law says if they show an actual reduction to practice, I don't like to concede anything, Your Honor, but I think that would be sufficient if they had an actual proven corroborated actual reduction to practice, because I think that what the law says is that the conception date would be the same as the actual reduction date in that instance.").

Second, in the absence of any challenge or evidence to the contrary, Mr. Charrat's filing of an oath and declaration with his U.S. Patent Application, Appx695-696, which issued as the '551 patent, is *prima facie* evidence that he is the sole inventor. *See, e.g.*, *Smith v. Goodyear Dental Vulcanite Co.*, 93 U.S. 486, 498 (1877) ("The patent itself is *prima facie* evidence that the patentee was the first inventor, at least it casts upon him who denies it the burden of sustaining his denial by proof."). Here, HTC did not contest Charrat's conception. And NFCT is not aware of any other claim that Charrat is not the sole inventor. There was therefore no need for the Board, *sua sponte*, to evaluate NFCT's conception evidence.

Third, the fact that electronics fabrication company Concept Electronique fabricated the prototype for Charrat and his INSIDE team should be of no concern or import. That is the norm in this industry. The Board's apparent suspicion in this regard, Appx16, is unwarranted. Fabrication companies make what they are asked to make. There is not one shred of evidence, or even an allegation, that Concept Electronique somehow had a hand in the claimed invention beyond fabricating the prototype PCB according to Mr. Charrat's instructions—it made what it was asked to make.

Finally, the sole basis for the Board's belief that NFCT had to sufficiently *prove* Charrat's conception was that such proof was supposedly necessary for "the concept Electronique-built prototype [to] inure[] to Patent Owner's benefit." Appx24. But the Board cites to no case standing for the proposition that the concept of "inurement" applies outside very specific instances in interference practice. Indeed, the only support that the Board has for its inurement argument are the three interference cases it cites: *Cooper v. Goldfarb*, 154 F.3d 1321 (Fed. Cir. 1998) ("Cooper I"), *Cooper v. Goldfarb*, 240 F.3d 1378 (Fed. Cir. 2001) ("Cooper II"), and *Genentech, Inc. v. Chiron Corp.*, 220 F.3d 1345 (Fed. Cir. 2000). Appx24.

Cooper I and *Cooper II* are related cases where Cooper (the senior party) argued that Goldfarb's (the junior party) reduction to practice should inure to

Cooper's benefit. *See Cooper I,* 154 F.3d at 1331. This court initially remanded the case to the Board to determine whether Goldfarb's work "inured" to Cooper. *Id*. at 1332. The Board subsequently "determined that the relationship between Cooper and Goldfarb was such that Goldfarb's work did not inure to Cooper's benefit and awarded priority of invention to Goldfarb," a result this court affirmed. *Cooper II*, 240 F.3d at 1380. The Cooper cases are distinguishable from anything that would arise in the context of simply antedating a reference—namely, Cooper sought to rely on the actions of his *adversary* Goldfarb to establish Cooper's own reduction to practice. There is no reason to extend the "inurement" doctrine from that unique interference case into the standards for antedating a prior-art reference under Rule 131. And in any event, unlike the interference between Messrs. Cooper and Goldfarb, Concept Electronique has not laid any claim to inventorship here.

Genentech is similarly distinguishable from the present case. *Genentech* involved the issue of whether a non-inventor's recognition of the utility of the invention could inure to the benefit of the inventors. *Genentech*, 220 F.3d at 1347. In *Genentech,* the inventors asked a third-party scientist to test certain proteins for the presence of a particular substance. *Id*. at 1354. While testing the proteins, that scientist recognized the utility of the proteins for the invention (*i.e.*, promoting growth), but never communicated this recognition to the inventors. *Id*. The inventors argued that this recognition of the utility should inure to their benefit because he was working under their direction. *Id*. However, because the scientist's recognition of utility was beyond the scope of his employment, and he never actually communicated that recognition, this court found that the scientist's "uncommunicated recognition that the fusion protein has that activity does not inure to their benefit." *Id*. In contrast to *Genentech*, the present case involved no issue of recognition of utility. Concept Electronique did not test the prototype—that fell to Mr. Charrat and his team at INSIDE. Again, there is no reason to extend this "inurement" analysis arising in the context of an interference into the evidentiary standards for antedating a prior art reference.

The inurement/interference cases that the Board cited should not control here. The Board was wrong to reach into interference case law, find a highly specific inurement doctrine, *sua sponte* make that doctrine a requirement for antedating a prior-art reference, and make that entire argument on HTC's behalf in its final written decision, thereby depriving NFCT of its ability to even respond. This is not an interference proceeding. Priority of inventorship is not in dispute. There is NO record evidence suggesting that Mr. Charrat is NOT the sole inventor.

III. Under the proper standards for antedating a prior-art reference, and under the correct burden of production, NFCT established a *prima facie* case that Mr. Charrat is the inventor.

The Board exceeded its authority in raising a conception/inurement argument on HTC's behalf. And in raising that defense for HTC, the Board erred by applying the legal standards for interferences instead of the appropriate standards for antedating references. But even if it did not exceed its authority, and even if conception/inurement were relevant with respect to NFCT's antedating argument, the Board still erred in evaluating NFCT's conception evidence.

A. The burden of production, which is different from the burden persuasion, is met with *prima facie* evidence.

The burden of persuasion is related to the standard of proof necessary to prove the facts of the claim at issue in a particular case. In IPR proceedings, that standard is "a preponderance of the evidence." 35 U.S.C. § 316(e). The burden of persuasion under that standard has been defined as the "burden to persuade the trier of fact that the existence of the proposition to be proved is more probably true than not." *See Keeler Brass Co. v. Cont'l Brass Co.*, 862 F.2d 1063, 1066 (4th Cir. 1988). It remains, at all times, with petitioner HTC. *Magnum Oil Tools*, 2016 WL 3974202, at *6.

The burden of production is different. In making its affirmative defense of antedating Sears, NFCT bore the burden of production. That burden was to "argue or produce evidence that either [a prior art reference] does not actually anticipate, or… is not prior art because the asserted claims… are entitled to the benefit of a filing date (constructive or otherwise) prior to the filing date" of the prior art reference. *Dynamic Drinkware, LLC*, 800 F.3d at 1380. The burden is also referred to as the "burden of going forward," and it "generally requires the production of sufficient evidence to support a finding in favor of that person." *Bruner v. Office of Pers. Mgmt.*, 996 F.2d 290, 293 (Fed. Cir. 1993). It may be met where a party makes out a *prima facie* case. *Id.* at 294. The Board erred in finding that NFCT did not meet that standard here.

B. NFCT made more than the required *prima facie* showing of Mr. Charrat's conception.

At the outset, Mr. Charrat is the sole named inventor of the '551 patent. In applying for the patent, he executed and filed a declaration, under oath, that he was the sole inventor. Appx696. This alone constitutes at least a *prima facie* showing that Mr. Charrat is the inventor of the '551 patent. *See Smith*, 93 U.S. at 498 ("The patent itself is *prima facie* evidence that the patentee was the first inventor, at least it casts upon him who denies it the burden of sustaining his denial by proof."). And this should have been the starting point for the Board's evaluation, under the rule of reason, of NFCT's *additional* conception evidence that it chose to provide as part of its story of the invention.

As part of describing the story of the invention, NFCT chose to introduce additional conception evidence, beyond the *prima facie* evidence on the face of the '551 patent, that Charrat is the inventor. NFCT provided the best evidence it had in the form of documentary evidence that corroborates Mr. Charrat's sworn testimony of conception. For example, NFCT provided:

- A design document Mr. Charrat drafted to set forth the problems that the M210H device should address. Appx2965-2966 and Appx2340.
- A product development request (PDR) defining, for the M210H device, goals that correspond to the functionality of the claimed device. Appx2967 and Appx2361-2363.
- A system overview document drafted by Mr. Charrat that presents an overview of the product that would contain the M210H device. Appx2967 and Appx2364-2368.
- Mr. Charrat's lab notebook entries detailing how various functional components of the M210H device would work together. Appx2967 and Appx2369-2375.
- Mr. Charrat's lab notebook entries relating to his work on implementing a Manchester coding scheme, which would be needed to implement the ISO/A standard. Appx2968 and Appx2376-2408.
- Mr. Charrat's lab notebook entries showing a layout for the M210H device that corresponds to the PCB layout that was used to build the prototype. Appx2969 and Appx2409-2441.
- A declaration by INSIDE employee Michel Martin discussing his involvement with the M210H device and testifying to the authenticity of Mr. Charrat's lab notebook entries. Appx1967-1970.

Such "[d]ocumentary or physical evidence that is made contemporaneously with the inventive process provides the most reliable proof that the inventor's testimony has been corroborated." *Sandt Tech., Ltd. v. Resco Metal & Plastics Corp., Corp.*, 264 F.3d 1344, 1350-51 (Fed. Cir. 2001) This evidence meets the legal standard for corroboration. *In re Garner*, 508 F.3d 1376, 1380 (Fed. Cir. 2007). In *Garner*, this Court explained that an inventor may "corroborate" testimony with independent evidence, which may consist of "testimony of a witness, other than the inventor, to the actual reduction to practice or it may consist of evidence surrounding facts and circumstances independent of information received from the inventor." *Id.* (internal citations omitted)

NFCT provided its evidence not to prove conception, *per se*, but rather to tell the story of the invention as completely as it could, nearly two-decades after the event. Though it was not needed, there was substantial evidence in the record to corroborate Mr. Charrat's testimony with respect to conception—particularly in view of the time that has passed since Mr. Charrat's conception. *Loral Fairchild Corp.*, 266 F.3d at 1365 (finding a patent owner's inability to produce certain test results understandable "considering that the events at issue occurred almost 30 years ago.").

On the other hand, there is no record evidence, or even an allegation, contradicting Mr. Charrat's conception testimony. All the Board found were perceived inconsistencies. *See* Appx28-29 (noting several perceived inconsistencies in the documentary evidence). But the Board's identification of inconsistencies in the evidence is not dispositive to the issue of whether NFCT properly corroborated Mr. Charrat's declaration under the rule of reason. *See e.g.*, *Ethicon, Inc. v. U. S. Surgical Corp.*, 135 F.3d 1456, 1464 (Fed. Cir. 1998) (finding that inconsistencies in corroborating evidence did not negate corroboration). Moreover, HTC never challenged conception and has waived its right to do so now.

When viewed in its proper context, NFCT's evidence supports at least a *prima facie* finding of conception. NFCT thus met its burden of production and the Board should have evaluated NFCT's evidence supporting its actual reduction to practice.

CONCLUSION AND RELIEF SOUGHT

The Board exceeded its authority *and* misapplied the law when it stepped into petitioner HTC's shoes to establish, on its behalf, a conception/inurement rebuttal to NFCT's affirmative defense that it has antedated the primary Sears patent. If this Court agrees with either argument, then the proper remedy is to remand the case to the Board so that it can review NFCT's actual-reduction-to-practice evidence.

If the Board did not exceed its authority and did not misapply the law, then a remand is still required because the Board erred evaluating whether NFCT had met its burden of production with respect to the inventor Mr. Charrat's conception. If this Court agrees, the Board would still need to review NFCT's actual-reduction-to-practice evidence.

Dated: August 17, 2016

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ADDENDUM TABLE OF CONTENTS

ITEM	PAGE
Final Written Decision (Paper 56)	Appx1
U.S. Patent No. 6,700,551	Appx50

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Paper 56
Entered: February 3, 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HTC CORPORATION and HTC AMERICA, INC.,
Petitioner,

v.

NFC TECHNOLOGY, LLC,
Patent Owner.

Case IPR2014-01198
Patent 6,700,551 B2

Before JAMES B. ARPIN, NEIL T. POWELL, and
BART A. GERSTENBLITH, *Administrative Patent Judges*.

ARPIN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

A. Background

HTC Corporation and HTC America, Inc. (collectively, "Petitioner") filed a Petition (Paper 1, "Pet.") to institute an *inter partes* review of claims 1–3 and 5 of Patent No. US 6,700,551 B2 (Ex. 1001, "the '551 patent") pursuant to 35 U.S.C. §§ 311–319. Pet. 1. NFC Technology, LLC ("Patent Owner") filed a Preliminary Response. Paper 9 ("Prelim. Resp."). On February 4, 2015, we issued a Decision on Institution (Paper 10, "Dec. on Inst."), instituting *inter partes* review of claims 1–3 and 5 of the '551 patent ("the challenged claims"). Dec. on Inst. 17–18. Subsequent to institution, Patent Owner filed a Patent Owner Response (Paper 18, "PO Resp."), Petitioner filed a Reply (Paper 42, "Pet. Reply") thereto, and Patent Owner filed a Sur-Reply (Paper 50, "PO Sur-Reply"). Further, Patent Owner filed a Motion for Observations on Cross-Examination of Petitioner's declarant, Dr. Emmanouil Tentzeris (Paper 47), and Petitioner filed a Response to Patent Owner's Motion for Observations (Paper 52).

The parties requested an oral hearing (Paper 46; Paper 48) and appeared before us on December 18, 2015. The record includes a transcript of the oral hearing. Paper 55 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73, addresses issues and evidence raised during the *inter partes* review. For the reasons that follow, Petitioner demonstrates by a preponderance of the evidence that claims 1–3 and 5 of the '551 patent are unpatentable.

B. Related Proceedings

Petitioner indicates that the ’551 patent is the subject of the following co-pending U.S. district court case: *NFC Technology LLC v. HTC Corp.*, No. 2:13-cv-1058 (E.D. Tex.), filed December 5, 2013. Pet. 1. In addition, at the request of Petitioner, we instituted an *inter partes* review, IPR2014-01199, with respect to a related patent, Patent No. US 7,665,664 B2, against Patent Owner. *HTC Corp. v. NFC Tech., LLC*, Case IPR2014-01199, slip op. at 3, 17 (PTAB Feb. 4, 2015) (Paper 10).

C. The ’551 Patent

The ’551 patent generally relates to methods and apparatus designed to wirelessly exchange data through inductive coupling, e.g., by radio-frequency identification (“RFID”) devices. Ex. 1001, col. 1, ll. 9–18. In particular, the ’551 patent relates to “portable electronic objects comprising a contactless integrated circuit, such as contactless smart card readers, electronic label scanners, electronic badge scanners,” and the like. *Id.* at col. 1, ll. 15–18. Specifically, “one object of the present invention is to provide a data transmission device of the type described above that can modulate the antenna signal with a modulation depth of less than 100% while being simple in structure and inexpensive to produce.” *Id.* at col. 1, ll. 61–65.

Figure 3 of the '551 patent is reproduced below:

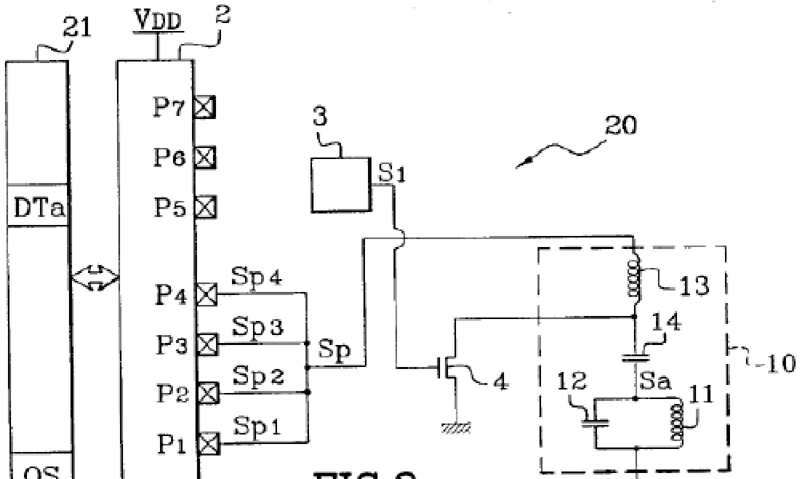

FIG.3

Figure 3 depicts an embodiment of the invention, in which microprocessor 2 employs a plurality of binary ports P1–P4 to produce the modulated antenna signal. *See id.* at col. 5, ll. 34–37. As explained in the Specification, "microprocessor 2 comprises binary ports P1 to P7 that can be set to '1' (voltage VDD), to '0' (output of the port to the ground) or to high impedance state." *Id.* at col. 3, ll. 32–34. In the embodiment of Figure 3, selected binary ports, e.g., ports P1–P4, are used to "deliver a power supply signal Sp which is the combination of signals Sp1, Sp2, Sp3, Sp4 delivered by each of the ports, and which is applied to the antenna circuit 10 by means of the inductor 13 and the capacitor 14 described above." *Id.* at col. 3, ll. 43–46. In the depicted embodiment, "the modulation of the antenna signal Sa is obtained by setting all the ports P1 to P4 to 0 or by setting certain ports to high impedance while the other ports are maintained on 1." *Id.* at col. 4, ll. 21–24. Thus, "setting all the ports P1 to P4 to 0" results in "the power supply signal Sp [being] zero and the amplitude of the antenna signal Sa [being] modulated at 100% (standard ISO/A)." *Id.* at col. 4, ll. 21–

26. Modulation of the amplitude of antenna signal Sa at less than 100% may be achieved by "setting certain ports to high impedance while the other ports are maintained on 1" in order to permit "a more substantial current [to] pass[] through the ports maintained on 1 and their internal resistor Ri [to] cause[] the voltage of the power supply signal Sp to drop without cancelling it." *Id.* at col. 4, ll. 21–31. Modulation switch 4 "is controlled by the signal S1 and does not receive an amplitude modulation signal delivered by the microprocessor, as was the case in previous practices." *Id.* at col. 3, ll. 49–52; *cf. id.* at Figs. 1, 2.

Although the embodiment of Figure 3 employs microprocessor 2, any type of control circuit providing features, such as those described above, may be used to achieve the disclosed methods and apparatus. *Id.* at col. 5, ll. 34–37. In particular, the '551 patent explains that the modulation may be controlled by binary ports that are a part of many off-the-shelf chips and are "simple in structure and inexpensive to produce." *Id.* at col. 1, ll. 64–65. Suitable integrated circuits "can include a microprocessor or a programmable logic circuit comprising 'port' type switch lines with a structure that is equivalent to that of a microprocessor port." *Id.* at col. 5, ll. 39–43.

D. Illustrative Claim

Petitioner challenges method claims 1–3 and apparatus claim 5 of the '551 patent. Pet. 3. Claim 1 is independent. Ex. 1001, col. 7, ll. 16–29. Each of claims 2, 3, and 5 depends directly from claim 1. Claim 1 of the '551 patent is illustrative of the claims at issue and is reproduced below:

> 1. Method for modulating the amplitude of the antenna signal of an inductive antenna circuit comprising a coil, by means of a control circuit comprising *binary ports that can be*

> *set to high impedance state* and with a non-zero internal resistor, characterised [sic] *in that the antenna circuit is electrically powered by at least two ports of the control circuit*, and in that it comprises steps of:
>
> setting the ports providing the electric supply of the antenna circuit to "1", to supply the antenna circuit at full power level, and
>
> *changing the state of at least one of the ports* providing the electric supply of the antenna circuit, to modulate the amplitude of the antenna signal.

Ex. 1001, col. 7, ll. 16–28 (emphases added).

E. Relied Upon References, Document, and Declarations

Petitioner relies upon the following references, document, and declaration in challenging the identified claims of the '551 patent:

Exhibit No.	References, Document, and Declaration
1002	Prosecution File History for the '551 Patent (U.S. Patent Application No. 09/962,889)
1003	Declaration of Dr. Emmanouil Tentzeris
1004	Patent No. US 6,122,492 to Sears ("Sears")
1005	Patent No. US 5,399,925 to Nguyen ("Nguyen")
1031	Rebuttal Declaration of Dr. Emmanouil Tentzeris

F. Grounds Under Review

Petitioner asserts that the challenged claims are unpatentable under 35 U.S.C. § 103(a) on the following specific grounds (Pet. 3–4, 11–60):

Ground	Reference(s)	Challenged Claims
35 U.S.C. § 103(a)	Sears	1–3 and 5
35 U.S.C. § 103(a)	Sears and Nguyen	1–3 and 5

II. ANALYSIS

A. Claim Construction

Consistent with the statute and the legislative history of the America Invents Act ("AIA"), we interpret claims of an unexpired patent using the broadest reasonable construction in light of the specification of the patent. Pet. 8; *see Office Patent Trial Practice Guide*, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012) (*Claim Construction*); 37 C.F.R. § 42.100(b).[1] Under the broadest reasonable construction standard, a claim term is presumed to have an ordinary and customary meaning as would have been understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). A patentee may act as his or her own lexicographer by providing a special definition for a claim term in the specification with "reasonable clarity, deliberateness, and precision." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Generally, in the absence of such a special definition or other considerations, "limitations are not to be read into the claims from the specification." *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).

1. Confirmation of Previous Constructions

In its Petition, Petitioner proposed constructions for the following claim terms: (1) "binary ports that can be set to high impedance states" (Claim 1), (2) "high impedance state" (Claim 3), (3) "non-zero internal resistor" (Claim 1), (4) "full power level" (Claim 1), and (5) "100%

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[1] *In re Cuozzo Speed Techs. LLC*, 793 F.3d 1268, 1277 ("Congress implicitly approved the broadest reasonable interpretation standard in enacting the AIA"), 1279 ("the standard was properly adopted by PTO regulation.") (Fed. Cir. 2015), *cert. granted sub nom. Cuozzo Speed Techs. LLC v. Lee*, 84 U.S.L.W. 3218 (Jan. 15, 2016) (No. 15-446).

modulation" (Claim 2). Pet. 9–11. We construed each of these terms for purposes of our Decision on Institution. Dec. on Inst. 6–10. Patent Owner does not contest those constructions in its Patent Owner Response. PO Resp. 8; *see* Paper 11, 2–3 ("The patent owner is cautioned that any arguments for patentability not raised in the response will be deemed waived."). Consequently, we now confirm our constructions of those claim terms, as follows:

a. "binary ports that can be set to high impedance state" (Claim 1)

"binary ports that can be set to high impedance state" means "a port or other portion of a circuit that can be set to binary logic '1,' binary logic '0,' or high impedance state" (Dec. on Inst. 8);

b. "high impedance state" (Claim 3)

"high impedance state" means "a state of a portion of a circuit when the portion is not driven to either the '0' (connection to ground) or '1' (connection to Vdd) states and the resistance of the port approaches or equals that of an open-circuit state" (*id.* at 9);

c. "non-zero internal resistor" (Claim 1)

"non-zero internal resistor" means "a component in the portion of the circuit that has a resistance above zero" (*id.* at 9–10);

d. "full power level" (Claim 1)

"full power level" means "setting the ports providing the electric supply of the antenna circuit to '1' to supply the antenna circuit at full power level" (*id.* at 10–11); and

e. "100% modulation" (Claim 3)

"100% modulation" means "reduction of the amplitude of the antenna signal from its maximum value nominally to zero" (*id.* at 11).

2. *Additional Constructions Proposed in Patent Owner Response*

In the Patent Owner Response, Patent Owner proposes constructions for additional terms: (1) "setting the ports providing the electric supply of the antenna circuit to '1'" (Claim 1) and (2) "set to '0'" (Claim 2). PO Resp. 8–9. In particular, Patent Owner contends that "a person of ordinary skill in the art would understand that setting to '1' or '0' means placing the port into one of two states (Ex. 2027, Apsel Dec., ¶ 36.)" PO Resp. 9. Petitioner argues that Patent Owner's proposed constructions improperly seek to incorporate a "setting individual ports" requirement into claim 1. Pet. Reply 3.

Claim 1 recites that "the antenna circuit is electrically powered by *at least two ports* of the control circuit" and the step of "*setting the ports* providing the electric supply of the antenna circuit *to '1'*." Ex. 1001, col. 7, ll. 20–25 (emphases added). Similarly, claim 2 recites "*the ports* providing the electric power supply of the antenna circuit *are set to '0'*." *Id.* at col. 7, ll. 29–31 (emphases added). We agree with Petitioner that the meaning of this claim language is that the "at least two ports" supplying electric power to the antenna circuit are both (or all) set to "1" or "0." While the steps of claims 1 and 2 may permit individually setting the ports (Ex. 2027 ¶ 36), the claim language makes clear that, in order to satisfy the claim language, all of the "at least two ports" supplying electric power of the antenna circuit must be *set* to "1" or "0."

Further, claim 1 recites the step of "changing the state of *at least one of the ports* providing the electric supply of the antenna circuit, to modulate the amplitude of the antenna signal." Ex. 1001, col. 7, ll. 26–28 (emphasis added). Thus, the claim terms considered in the context of the language of claim 1, as a whole, make clear that the "setting" step applies to the "at least *two* ports" and the "changing" step applies to "at least *one* of the ports." (Emphases added).

"In claim construction, [the Federal Circuit] gives primacy to the language of the claims, followed by the specification." *Tempo Lighting Inc. v. Tivoli LLC*, 742 F.3d 973, 977 (Fed. Cir. 2014) (citing *In re Morris*, 127 F.3d 1048, 1056 (Fed. Cir. 1997)). The Specification of the '551 patent makes clear that "this 100% modulation is 'obtained by *simultaneously* setting ports P1 to P4 to 0 (signals SP1 to SP4 to 0).'" PO Resp. 8 (quoting Ex. 1001, col. 5, ll. 5–8); *see also* Ex. 1001, col. 3, ll. 54–57 ("According to the method of the present invention, *the four ports P1 to P4 are maintained on state '1'* (voltage VDD present on the ports) to supply the antenna circuit 10 at full power level" (emphasis added)).

Therefore, the broadest reasonable interpretation of the term "setting the ports providing the electric supply of the antenna circuit to '1'" (Claim 1) is "setting two or more of the at least two ports supplying electric power to the antenna circuit to '1'" and of the term "set to '0'" (Claim 2) is to "set two or more of the at least two ports supplying electric power to the antenna circuit to '0'."[2] *See* Ex. 1031 ¶ 36.

3. Other Claim Terms

Neither party offers constructions of other terms in the challenged claims. *See* Pet. 9–11; PO Resp. 8–9. Only terms that are in controversy in

[2] Patent Owner does not base its constructions in the prosecution history of the '551 patent (*see* Ex. 1002), but does rely on a declarant's testimony as to the meaning of these terms to a person of skill in the art (Ex. 2027). On this record, the construction of these terms would not differ under the *Phillips* standard. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

this proceeding need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999). Therefore, no other claim terms require express construction.

B. Antedating Sears

Petitioner argues that claims 1–3 and 5 of the '551 patent would have been rendered obvious over Sears and over Sears and Nguyen. Pet. 3. We instituted *inter partes* review on those grounds. *See supra* Section I.F; Dec. on Inst. 17–18. Initially, Patent Owner contends that Sears does not constitute prior art under 35 U.S.C. § 102(e), as Petitioner alleges. PO Resp. 9; *see* Pet. 3. For the reasons set forth below, we are not persuaded that the inventor's testimony is corroborated adequately, and we determine that Patent Owner has not met its burden of producing sufficient evidence that the subject matter of the challenged claims was invented prior to February 8, 1999, the filing date of Sears.

1. Background

a. Patent Owner's Contentions

As noted above, Patent Owner contends that Sears does not constitute prior art to the challenged claims of the '551 patent under 35 U.S.C. § 102(e), as Petitioner alleges. PO Resp. 9–34. The French patent application, from which the '551 patent claims the benefit, was filed on March 25, 1999 (*id.* at 1–2; Pet. 3; Ex. 1001, (30) (63)); and the U.S. patent application that eventually issued as Sears was filed on February 8, 1999 (PO Resp. 9; Pet. 3; Ex. 1004, (22)). Patent Owner contends that the subject matter recited in the challenged claims of the '551 patent was "actually reduced to practice on or before November 1998," i.e., before February 8,

1999. PO Resp. 9. In support of this contention, Patent Owner provides declarations of: the sole named inventor, Bruno Charrat, Chief Operating Officer at b-pack (Ex. 2023); as well as André Marchand, a patent attorney at Omnipat in Aix-en-Provence, France (Ex. 2024); and Francois Lepron, an engineer at INSIDE Technologies ("INSIDE") at the time of the alleged actual reduction of the subject matter of the challenged claims to practice (Ex. 2025 (expunged)). Although Mr. Lepron executed a declaration in support of Patent Owner's contentions regarding the actual reduction to practice of the recited subject matter, Mr. Lepron refused "for personal reasons" to be deposed by Petitioner. Ex. 1023 (English translation of e-mail from Mr. Lepron to Murielle Greusard, France Brevets). Consequently, we authorized Petitioner to file a Motion to Strike Mr. Lepron's declaration (Paper 38), which Petitioner did (Paper 39), and, after considering Patent Owner's Opposition to the Motion to Strike (Paper 40), granted Petitioner's Motion (Paper 41) and expunged Mr. Lepron's declaration (Ex. 2025). *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,761 (Aug. 14, 2012); 37 C.F.R. §§ 41.51(b), 42.53(g). As a result, Mr. Lepron's declaration is no longer part of the record in this proceeding, and "to the extent that Patent Owner relies on Exhibit 2025, wholly or in part, as evidence to support argument in the Patent Owner Response, we give no weight to that reliance on expunged Exhibit 2025." Paper 41, 5.

i. Conception by Mr. Charrat

Patent Owner contends that Mr. Charrat conceived of the subject matter recited in the challenged claims on or before September 10, 1998. PO Resp. 16. Specifically, Patent Owner contends that, in mid-1998, "*engineers* at a company called INSIDE Technologies (later renamed INSIDE Contactless and then renamed as INSIDE Secure) began work on what the company called M210H."[3] *Id.* at 11–12 (emphasis added). This device was to be "compatible with both of the ISO/A and ISO/B standards, yet having fewer components than the previous INSIDE devices." *Id.* at 12. In particular, the ISO/A standard requires the modulation of a transmission signal by 100%, and the ISO/B standard requires the modulation of a transmission signal by only 10%. *Id.* (citing Ex. 2026, 4, 8). The M210H was required to operate in accordance with either standard. *Id.* (citing Ex. 2023 ¶ 23).

According to Patent Owner,

> Mr. Charrat provided that solution in September of 1998 when he conceived of using available tri-state binary ports of an off-the-shelf microprocessor to achieve the variable modulation. ([Ex. 2023] ¶¶ 25–26.) Specifically, by September 10, Mr. Charrat had fully worked out how to implement the design of the M210H using only available microprocessor ports (as opposed to a separate modulation circuit) to modulate the carrier signal. (*Id.* at ¶ 34.) Indeed, he had already begun the process of implementing the device as hand-drawn layouts in his notebook at that time show.

PO Resp. 13.

In support of its contention that Mr. Charrat conceived of the recited subject matter of the challenged claims, Patent Owner relies primarily on two pieces of evidence, in addition to Mr. Charrat's testimony (Ex. 2023). First, Patent Owner relies on excerpts from Mr. Charrat's laboratory notebook. PO Resp. 13–14 (reproducing Figure 3 of Ex. 2006). Although some of the laboratory notebook pages are dated, the laboratory notebooks are neither signed by Mr. Charrat nor witnessed by another person. Tr. 39:20–40:7 ("The notebooks are not signed by anyone. These are not notebooks that are maintained in the same sense as an inventor's lab notebook would be maintained in accordance with United States law."); *see id.* at 49:14–20. Moreover, the notebook excerpts reproduced in Exhibits 2004–2006 do not appear to be the original notebooks' pages, but, instead, appear to be reproductions of pages annotated by Patent Owner to include certified translations of the French text from the notebooks. *E.g.*, Ex. 2004, 4 (certification of translation); *see* Ex. 2030 ¶ 2. Second, Patent Owner relies on "a high-level block diagram of the M210H showing a processor directly connected to an emitter, which is itself connected to an antenna." PO Resp. 15 (citing Ex. 2001, Fig. 4). Patent Owner contends that "Mr. Charrat began his efforts to design the M210H project on or before June 26, 1998, when he drafted an initial project data sheet memorializing the requirements of the M210H device. (*See*, Ex. 2001, p. 2.)" PO Resp. 14.

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[3] Patent Owner contends that "[a]ll of the development of the M210H device occurred in Aix-en-Provence, France, which is a WTO country. Accordingly, the inventor is entitled to the same priority rights 'as if such invention had been made in the United States.'" PO Resp. 12 n.2 (quoting 35 U.S.C. § 104(a)(C)(2) (pre-AIA)). Petitioner does not contest the contention.

Referring to Exhibit 2001, Mr. Charrat testifies that

> This project to develop a microcontroller-based modulation (the project that would ultimately be described in the '551 patent) began on or before June 26, 1998, when *I produced* an initial project data sheet detailing the requirements for a project that was, at the time, called Readcrypt M210H. A subsequent version of this document dated July 21, 2007,[[4]] is attached as Ex. 2001 and details various features of the M210H project.

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[4] Mr. Charrat testifies that data sheet that "evolved" into Exhibit 2001,

Ex. 2023 ¶ 28 (emphasis added). There is no author named on this datasheet (Ex. 2001), and only Patent Owner's argument and Mr. Charrat's own testimony asserts that Mr. Charrat is the author of the data sheet.

After the initial data sheet for the M210H device was prepared on June 28, 1998, Patent Owner contends that

> Mr. Charrat *and others* generated a product development request (PDR). Like the data sheet, the PDR outlined general requirements for the M210H device, which included a requirement for compatibility with both the ISO/A and ISO/B standards. (Ex. 2023, Charrat Dec., ¶ 30; Ex. 2002.) Another contemporaneous internal document *from INSIDE* also lays out the requirement that the M210H low-cost reader would need to "read ISO A & B chips." ([Ex. 2023] ¶ 31; Ex. 2003, p. 5.)

PO Resp. 15–16 (emphases added). Neither Patent Owner nor Mr. Charrat contends that Mr. Charrat alone produced either Exhibit 2002 or Exhibit 2003, and again neither exhibit identifies its author. Nevertheless, Mr. Charrat testifies that, after the requirements for the M210H device had been identified, he continued to work on the design of the device, and "[b]y September 10, 1998, [he] had fully conceived of the idea of using a PIC16C63 microprocessor to power and control the modulation of the antenna." PO Resp. 16 (citing Ex. 2023 ¶ 34).

ii. Actual Reduction to Practice by the INSIDE Team

After the design for the M210H device had been created, Patent Owner contends that Mr. Charrat worked with his development team at INSIDE, consisting of Mr. Charrat, Mr. Lepron, Alban de Moncuit, and

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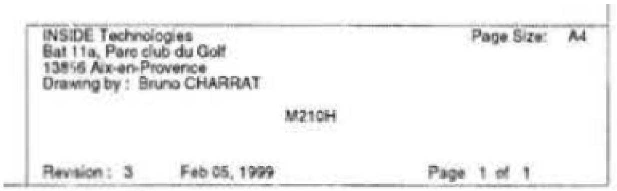
which originally was created on July 21, 1998, but that Exhibit 2001 is properly dated "July 21, 2007," more than eight (8) years after Sears's filing date. Ex. 2023 ¶ 28 n.3.

Rodrigue Gil, to construct a working prototype. *Id.* (citing Ex. 2023 ¶ 13). In September of 1998, Mr. Charrat contends that the development of the M210H device was sufficient, such that "INSIDE commissioned a company called Concept Electronique to generate printed circuit board (PCB) layouts for the prototype M210H device. (Ex. 2023, Charrat Dec., ¶¶ 36–38.) Concept Electronique generated the PCB layout and sent it to INSIDE for approval." PO Resp. 17. The PCB layouts *generated by Concept Electronique* are depicted in Exhibit 2007. *See* PO Resp. 17–18 (reproducing figures from Ex. 2007, 4–9).

Patent Owner contends that, on September 10, 1998, Mr. Charrat instructed Concept Electronique to fabricate a prototype of the M210H device. Ex. 2009 (return of facsimile cover sheet stating "OK FAB" signed by Mr. Charrat and dated "10/09/98"); *see* Tr. 33:20–34:6. Patent Owner acknowledges, however, that it does not have direct evidence showing what the INSIDE team of engineers sent to Concept Electronique or what was contained in the four (4) pages Concept Electronique sent to the INSIDE team as an attachment to the facsimile cover sheet. *See* Tr. 34:7–13.

Nevertheless, Patent Owner contends that the prototype, which was fabricated by Concept Electronique, was tested by the INSIDE team and performed according to the recited limitations of the challenged claims. PO Resp. 19–21. In November of 1998, Mr. de Moncuit allegedly prepared a report (Ex. 2012) indicating that the Concept Electronique prototype device was capable of both 100% modulation and 10% modulation and "worked for its intended purpose of being compatible with both the ISO/A and ISO/B standards." *Id.* at 20–21 (citing Ex. 2023 ¶ 45); *see* Ex. 2012, 7 (depicting test results for 100% modulation), 8 (depicting test results for 10% modulation). Exhibit 2012 does not name its author.

Although Exhibits 2007 and 2009 refer to the "M210H" device (Ex. 2007, 1–3, 6, 8–12; Ex. 2009, 1, 3) and Patent Owner contends that this reference to the "M210H" device links these two documents (Tr. 35:14–36:20), Exhibit 2012 refers to the "M210H-2" device, rather than the "M210H" device (Ex. 2012, 3; *see* Tr. 22:17–23:10). During his deposition, Mr. Charrat was unable to explain what the "M210H-2" device was or how it differed from the "M210H" device. Ex. 1026, 32:17–33:3; *see* Tr. 48:13–24. Further, Patent Owner contends that the INSIDE team verified that the Concept Electronique prototype conformed to their design. PO Resp. 21–22 (reproducing the highlighted wiring diagram of Ex. 2013). The legend of Exhibit 2013 is reproduced below:


INSIDE Technologies
Bat 11a, Parc club du Golf
13856 Aix-en-Provence
Drawing by : Bruno CHARRAT
Page Size: A4

M210H

Revision : 3 Feb 05, 1999 Page 1 of 1

Ex. 2013, 1. As shown in the reproduced portion, Exhibit 2013 is identified as "Revision: 3" and is dated "Feb 05, 1999," over two months *after* Mr. de Moncuit prepared his report on the M210H-2 device manufactured by Concept Electronique. *Id.*; *see* Ex. 2012, 1.

Patent Owner contends that, on January 15, 1999, Mr. Charrat met with his attorney, Mr. Marchand, to discuss the preparation of a patent application claiming the invention corresponding to the Concept Electronique prototype. PO Resp. 22–26. Mr. Marchand testifies that

> Mr. Charrat explained to me that *the M210H device* operated at 13.56 MHz using a large coil (i.e., inductive antenna) connected to the reader. (Ex. 2015, p. 1.) Furthermore, *Mr. Charrat's*

> *prototype device* used a commercially available microcontroller (i.e., the PIC16C63 in this case) to power the antenna. (Ex. 2016, p. 1.) Additionally, my notes (Ex. 2015) reflect that Mr. Charrat explained to me that the device connected multiple ports (5 indicated in these notes), which allowed the transmitter to employ either of the ISO/A (100% modulation) or the ISO/B (i.e., 10% modulation) standards. (*Id.*, p. 4.)

Ex. 2024 ¶ 8 (emphases added); *see* Ex. 1032 ¶¶ 3, 4. In particular, Patent Owner contends that,

> [o]n February 24, 1999, Mr. Marchand sent Mr. Charrat a first draft of the patent application *containing the description of the M210H prototype device*. . . . After some minor corrections to the first draft, a second draft was sent to Mr. Charrat and the application was filed on March 25, 1999. . . . This application *described the M210H prototype that Mr. Charrat had designed, built, and tested in November 1998*.

PO Resp. 25–26 (emphases added) (citing Ex. 2023 ¶¶ 55–57; Ex. 2024 ¶¶ 11, 13–15). Thus, Mr. Marchand drafted an application based on Mr. Charrat's description of the Concept Electronique prototype that allegedly embodies Mr. Charrat's invention, as described to Mr. Marchand, but Mr. Marchand admitted that he has no personal knowledge that the described prototype had been made or tested. Ex. 1024, 26:25–27:14.

Finally, Patent Owner contends that the Concept Electronique prototype satisfies all of the limitations of claims 1–3 and 5 of the '551 patent. PO Resp. 26–33. Accordingly, in view of the arguments and evidence presented in Patent Owner's Response (*id.* at 11–34), Patent Owner contends that it has met "its burden, under at least a preponderance of the evidence, to show an actual reduction to practice of the claimed subject matter prior to the effective prior art date of the Sears reference" (*id.* at 34).

b. Petitioner's Reply

Petitioner responds that Patent Owner's evidence allegedly showing the fabrication, testing, and verification of the Concept Electronique prototype "lack[s] independent corroboration because they are authenticated and corroborated solely by the inventor himself." Pet. Reply 10–12. In particular, Petitioner argues that the evidence that Patent Owner primarily relies upon in support of its contentions, namely, the PCB Layout, generated by Concept Electronique (Ex. 2007); the facsimile cover sheet, dated September 10, 1998 (Ex. 2009); and the test report, prepared by Mr. de Moncuit and dated November 1998 (Ex. 2012), are corroborated *only* by Mr. Charrat's testimony. *See* Pet. Reply 11–12. Moreover, the other evidence that Patent Owner relies upon in support of its contentions, namely, materials produced by INSIDE personnel (Exs. 2001–2003) and excerpts from Mr. Charrat's notebooks (Exs. 2004–2006, 2010, and 2011) also are corroborated *only* by Mr. Charrat's testimony. Pet. Reply 12–13. Further, Petitioner argues that the documents created by Mr. Marchand or his staff in connection with the preparation of the French patent application, from which the '551 patent claims priority, (Exs. 2015–2022) are not properly corroborated because of Mr. Marchand's alleged bias. Pet. Reply 13–14.

In addition, Petitioner argues that the Concept Electronique prototype

> did not work for its intended purpose because: (1) no software necessary to perform ISO/A and B modulations had been developed at the time of the Nov. 98 Tests (Ex. 1031, ¶¶120–127); (2) the hardware tested in the Nov. 98 Tests was incapable of performing these modulations (*id.* at ¶¶110–115); and (3) the two separate tests PO cites from the Nov. 98 Tests, at best, tested two different devices and not a single fabricated device (*id.* at ¶79). Because the M210H Prototype did not work,

> it lacked a processor capable of powering an antenna and modulating antenna signals, as required by claims 1-3 and 5.

Pet. Reply 14. In particular, Petitioner argues that software was necessary for the prototype to operate according to its intended purpose (Ex. 1026, 17:12–18:9), but that Mr. Lepron, the engineer tasked with developing that software (Ex. 1026, 11:22–24), did not work on the project between September and November of 1998, during which time the prototype was fabricated. Pet. Reply 14–16 (citing Ex. 1031 ¶¶ 120–122, 124). Further, Petitioner argues that, because harmonic noise also was introduced into the prototype by its transistor 2N7002, the Concept Electronique prototype failed to operate for its intended purpose. *Id.* at 16–20. Specifically, the level of noise generated in the prototype was too high to permit the recited modulation levels. *Id.* at 17. Finally, Petitioner argues that the tests described in Exhibit 2012 rely on two separate wiring configurations and thus do not support Patent Owner's claim that the subject matter of the challenged claims was actually reduced to practice. *Id.* at 20–22. In particular, Petitioner argues that

> [i]n one test, the 'transmitter is supplied by **4-micro-controller ports**.' Ex. 2012, 7 (emphasis added); Ex. 1031, ¶79. In the second test, only 3 ports are used with respect to the transmitter. [Ex. 2012], 8; Ex. 1031, ¶ 79. The 4th port of the 3-port test is entirely unaccounted for.

Pet. Reply 20–21.

Petitioner argues that Patent Owner's evidence is contradictory and cannot support its contention that the subject matter of the challenged claims was actually reduced to practice before the filing date of Sears. *Id.* at 22–25. Because Patent Owner relies solely on actual reduction to practice to antedate Sears, Petitioner argues that Patent Owner has failed to meet its burden and urges that "the Board should not and need not address any factors relating to conception or diligence." Pet. Reply 25 (citing *Scott v. Finney*, 34 F. 3d 1058, 1060 (Fed. Cir. 1994) (only addressing actual reduction to practice because PO opted to argue it)).

c. Patent Owner's Sur-Reply

Because Patent Owner bears the burden of production regarding evidence supporting the antedating of Sears, we granted Patent Owner's request to file a Sur-Reply limited to the question of antedating. Paper 45, 3–5. Patent Owner contends that Petitioner's arguments challenging Patent Owner's efforts to antedate Sears are flawed for three reasons. PO Sur-Reply 1. First, Patent Owner contends Petitioner's "lack-of-corroboration arguments are legally flawed because they conflate authentication with corroboration." *Id.* at 1–3. In particular, Patent Owner contends that "'[c]orroboration' deals with *sufficiency* of the evidence, while 'authentication' deals [with] its admissibility." *Id.* at 1 (emphasis added). Further, lack of authentication is an evidentiary issue properly addressed by a motion to exclude evidence. *Id.* at 3. Thus, Patent Owner contends that Mr. Charrat's testimony is sufficiently and independently corroborated by other pieces of documentary evidence. *Id.* at 3; *but see In re NTP, Inc.*, 654 F.3d 1279, 1293 (Fed. Cir. 2011) (rejecting the "circular logic of using the files to corroborate the testimony and the testimony to corroborate the files").

Second, Patent Owner contends that Petitioner overstates what is legally required to show actual reduction to practice. *Id.* at 4–5. In particular, Patent Owner contends that, in order to show actual reduction to practice, Patent Owner "need only show that [the] invention has been sufficiently tested to demonstrate that it will work for its intended purpose, but it need not be in a commercially satisfactory stage of development." *Id.* at 4; *see Scott*, 34 F.3d at 1062. Thus, the presence of "harmonic noise" or other minor deficiencies in the prototype are not sufficient to prevent the prototype from showing actual reduction to practice. *Id.* at 4–5 (citing Ex. 2023 ¶¶ 44, 45); *see* Pet. Reply 17.

Third, Patent Owner contends that Petitioner's rebuttal "evidence" improperly relies on its declarant's, Dr. Tentzeris's, factual testimony; but Patent Owner contends that Dr. Tentzeris has no personal knowledge of the facts surrounding the actual reduction to practice of Mr. Charrat's purported invention. *Id.* at 5; *see* Paper 47, 1–6.[5] Thus, Patent Owner contends that Dr. Tentzeris's testimony regarding the facts surrounding the actual reduction to practice of the subject matter of the challenged claims should be given little or no weight. *Id.*

2. Discussion

Petitioner bears the burden of persuasion, by a preponderance of the evidence, that the challenged claims are unpatentable. 35 U.S.C. § 316(e). Petitioner has proffered Sears, which presumptively constitutes prior art under 35 U.S.C. § 102(e) because it was filed in the U.S. Patent and Trademark Office on February 8, 1999, *before* the filing date, i.e., March 25, 1999, of the French parent application of the '551 patent. This difference in dates gives rise to Patent Owner's burden to produce evidence supporting a date of invention before the Sears's filing date, i.e., before February 8, 1999. *See Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1576–77 (Fed. Cir. 1996).

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[5] We do not rely on Dr. Tentzeris's testimony regarding Exhibits 2007, 2009, and 2012, and regarding INSIDE Technologies in our analysis of Patent Owner's contentions with respect to the antedating of Sears. *See* Paper 47; Paper 52.

"To antedate . . . an invention, a party must show either an earlier reduction to practice, *or* an earlier conception followed by a diligent reduction to practice." *Purdue Pharma L.P. v. Boehringer Ingelheim GMBH*, 237 F.3d 1359, 1365 (Fed. Cir. 2001) (emphasis added, internal citation omitted). Patent Owner's position is based on the first of these options, i.e., that it was the first actually to reduce the invention to practice, rather than the first to conceive plus diligent reduction to practice. PO Resp. 9; PO Sur-Reply 4–5.

A party seeking to establish an actual reduction to practice must satisfy a two-prong test: (1) the party must construct an embodiment or perform a process that satisfies every element of the claim at issue, and (2) the embodiment or process must operate for its intended purpose. *See Eaton v. Evans*, 204 F.3d 1094, 1097 (Fed. Cir. 2000). Moreover, in order to demonstrate an actual reduction to practice, the constructed embodiment must have been tested sufficiently to demonstrate that it will work for its intended purpose, but it need not be in a commercially satisfactory stage of development. *See, e.g.*, *Scott*, 34 F.3d at 1062; *see also Wells v. Fremont*, 177 USPQ 22, 24–25 (BPAI 1972) ("[E]ven where tests are conducted under 'bench' or laboratory conditions, those conditions must 'fully duplicate each and every condition of actual use' or if they do not, then the evidence must establish a relationship between the subject matter, the test condition and the intended functional setting of the invention," but it is not necessary that all the conditions of actual use are duplicated.). Further, an actual reduction to practice can be done by another on behalf of the inventor. *De Solms v.*

Schoenwald, 15 USPQ2d 1507, 1510 (BPAI 1990). Here, it is undisputed that Concept Electronique, rather than the named inventor, Mr. Charrat, fabricated the prototype, on which Patent Owner relies to establish actual reduction to practice. PO Resp. 17–18. Assuming initially, without deciding, that the prototype embodies the subject matter of the challenged claims, the issue is whether Patent Owner has sufficiently shown that the Concept Electronique-built prototype inures to Patent Owner's benefit. We determine that Patent Owner has not.

If a person conceives of an invention and proceeds himself or herself actually to reduce that invention to practice, the actual reduction to practice is sufficient evidence of conception, at least as of the date that the actual reduction to practice is completed. Here, Patent Owner contends that Concept Electronique's prototype inures to its benefit because acts by others working explicitly or implicitly at an inventor's request may inure to that inventor's benefit. *Cooper v. Goldfarb*, 154 F.3d 1321, 1332 (Fed. Cir. 1998) ("*Cooper I*"). However, when a person relies on the activities of others to show actual reduction to practice, proof of conception is relevant to the inurement analysis. *See Sensio, Inc. v. Select Brands, Inc.*, Case IPR2013-00580, slip op. at 10–15 (PTAB Feb. 9, 2015) (Paper 31); *but see* Tr. 14:11–15:9. Under *Genentech, Inc. v. Chiron Corp.*, 220 F.3d 1345, 1354 (Fed. Cir. 2000), and *Cooper v. Goldfarb*, 240 F.3d 1378, 1383 (Fed. Cir. 2001) ("*Cooper II*")), Patent Owner must show that Mr. Charrat conceived the subject matter of the challenged claims and communicated that subject matter to Concept Electronique in order for the fabricated prototype to inure to Mr. Charrat's benefit.[6] For example, in *Genentech*, in the context of deciding whether a non-inventor's recognition of the utility of a reduction to practice inured to the inventor's benefit, the Federal Circuit held that the inventor *first* must show that it conceived the invention. *Genentech*, 220 F.3d at 1354.

Conception is complete when the idea is so clearly defined in the inventor's mind that only ordinary skill is necessary to reduce the invention to practice. *Burroughs Wellcome Co. v. Barr Labs., Inc.* 40 F.3d 1223, 1228 (Fed. Cir. 1994). In *Cooper II*, the United States Court of Appeals for the Federal Circuit applied "a modified version of the *Genentech* test" to a different issue, requiring a party to show that it conceived the invention to obtain the benefit of another party's knowledge that a tested material met the limitation of the interference count. *Cooper II*, 240 F.3d at 1385. *Cooper II* demonstrates the Federal Circuit's view that conception must be shown whenever a party seeks the benefit of another party's actual reduction to practice. This requirement makes sense; otherwise, a person could establish that she is the first inventor without showing either that she was the first to conceive or the first to reduce to practice, contrary to the requirements for antedating an invention. *See Purdue Pharma*, 237 F.3d at 1365.

The case on which Patent Owner relies, *Cooper I*, is not to the contrary. PO Resp. 10; PO Sur-Reply 4. In *Cooper I*, the Federal Circuit

[6] *See also Hoop v. Hoop*, 279 F.3d 1004, 1007 (Fed. Cir. 2002) (in a design-patent interference case, holding that the "'person or persons who *conceived* the patented [design]' . . . *may then* '*use* the services, ideas, and aid of others in the process of perfecting his invention without losing his right to a patent'" (emphases added)). The standard of inventorship is the same for utility and design patents. *Id.*

noted that, under the inurement doctrine, the benefit of actions of a non-inventor only may inure to the person, who did first conceive the invention at issue. *See Cooper I*, 154 F.3d at 1331. In particular, the Federal Circuit explained that "experiments conducted at the request of *an inventor* by another party may inure to the benefit of *the inventor* for purposes of establishing a reduction to practice." *Id.* (emphases added). Nevertheless, Patent Owner contends here that it has presented sufficient evidence to demonstrate that Mr. Charrat conceived the subject matter of the challenged claims before Concept Electronique fabricated its prototype. PO Resp. 14–16; *see* Tr. 28:1–22. For the reasons that follow, we are not persuaded that Patent Owner has shown that Mr. Charrat conceived the subject matter of the challenged claims and, consequently, that the actions of the INSIDE team or Concept Electronique inure to Mr. Charrat's benefit.

Patent Owner has produced insufficient evidence to show that Mr. Charrat conceived the subject matter of the challenged claims prior to November of 1998, the alleged date of the actual reduction to practice of the claimed subject matter. Patent Owner points us to Mr. Charrat's testimony that he designed the M210H device and communicated the design of the M210H device to Concept Electronique for fabrication. PO Resp. 14–18 (citing Ex. 2023 ¶¶ 34–38); *see* PO Sur-Reply 1–2. Specifically, Mr. Charrat testifies that he began the project to develop a microcontroller-based modulation device on or before June 26, 1998, when he produced an initial project data sheet detailing the requirements for a project that was, at the time, called Readcrypt M210H. Ex. 2023 ¶ 28. However, "an inventor's testimony, standing alone, is insufficient to prove conception—some form of corroboration must be shown." *Price v. Symsek*, 988 F.2d 1187, 1194 (Fed. Cir. 1993) (internal citation omitted).

The corroboration requirement "provides a bright line for . . . the PTO to follow in addressing the difficult issues related to invention dates." *Mahurkar*, 79 F.3d at 1577. In assessing corroboration, a "rule of reason analysis is applied," in which "an evaluation of all pertinent evidence must be made so that a sound determination of the credibility of the inventor's story may be reached." *Id.* (internal quotation marks and citation omitted). However, "[t]he rule of reason . . . does not dispense with the requirement for some evidence of independent corroboration." *Coleman v. Dines*, 754 F.2d 353, 360 (Fed. Cir. 1985); *see* PO Sur-Reply 1 (citing *Medichem S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1170 (Fed. Cir. 2006)).

Patent Owner argues that the evidence of record shows that Concept Electronique fabricated the prototype according to Mr. Charrat's design and at Mr. Charrat's direction, which corroborates the inventor's testimony under the rule of reason. PO Sur-Reply 1–3. We understand that the "evidence of record," to which Patent Owner refers, includes (1) the initial project data sheet memorializing the requirements of the M210H device, drafted by the INSIDE team (Ex. 2001); (2) the PCB Layout, generated by Concept Electronique (Ex. 2007); (3) the facsimile cover sheet, dated September 10, 1998 (Ex. 2009); (4) the test report, prepared by Mr. de Moncuit and dated November 1998 (Ex. 2012); and (5) a highlighted wiring schematic for the Concept Electronique prototype (Ex. 2013). PO Resp. 14–22; PO Sur-Reply 2–3. We have reviewed each of these exhibits and are not persuaded that they corroborate the inventor's testimony regarding conception. In particular, none of these exhibits addresses directly who conceived the subject matter of the challenged claims and when that person or persons did so.

As noted above, there is no author named on the initial project data sheet (Ex. 2001), and only Mr. Charrat's own testimony asserts that he is the author of the data sheet. PO Resp. 14; Ex. 2023 ¶ 28. Patent Owner acknowledges that the PCB Layout (Ex. 2007) was generated by Concept Electronique, not by Mr. Charrat or by the INSIDE team. PO Resp. 17–18. Although Patent Owner contends that Mr. Charrat conceived the subject matter of the challenged claims, Patent Owner does not produce documents, other than Mr. Charrat's notebooks (e.g., Exs. 2004–2006), which were prepared by Mr. Charrat and allegedly show the subject matter of the challenged claims. As noted above, however, the case law prohibits the "circular logic of using the files to corroborate the testimony and the testimony to corroborate the files." *NTP*, 654 F.3d at 1293.

Further, as Patent Owner acknowledged during the oral hearing, the notebooks are neither signed by Mr. Charrat nor witnessed by any other person. Tr. 39:20–24 ("The notebooks are not signed by anyone."); *see* Exs. 2004–2006. We recognize that Mr. Charrat did not create or maintain these notebooks for the purpose of proving conception in the United States. *See id.* at 39:24–40:7. Nevertheless, we assess the value of these notebooks as corroboration for Mr. Charrat's testimony regarding conception (*see* Ex. 2023 ¶ 28) by U.S. legal standards, and we find that the unsigned and unwitnessed notebooks are insufficient corroborative evidence of conception.

Although Mr. Charrat's testimony and the notebooks he allegedly created may be insufficient evidence to establish conception, independent circumstantial evidence may supply sufficient corroborating evidence of conception. *See Lacotte v. Thomas*, 758 F.2d 611, 613 (Fed. Cir. 1985); *see also Reese v. Hurst*, 661 F.2d 1222, 1225 (CCPA 1981) ("Independent corroboration may consist of testimony of a witness, other than the inventor, to the actual reduction to practice or it may consist of evidence of surrounding facts and circumstances *independent of information received from the inventor*." (emphasis added)). We are not persuaded that Patent Owner has presented such corroborating evidence here.

Patent Owner contends that the facsimile cover sheet (Ex. 2009), dated September 10, 1998, instructing Concept Electronique to fabricate a prototype is evidence that Mr. Charrat directed the efforts of a third party actually to reduce his design for the device to practice. Tr. 33:20–34:6. Nevertheless, Patent Owner does not produce evidence showing what the INSIDE team of engineers sent to Concept Electronique or the four (4) page document Concept Electronique attached to the facsimile cover sheet (Ex. 2009) that Concept Electronique returned to INSIDE. *See* Tr. 34:7–13. This lack of evidence, combined with the differing identifications of the prototype on Exhibit 2009 ("M210H") and on the post-fabrication test report, Exhibit 2012 ("M210H-2"), place in question what was fabricated and who provided the design used by the fabricators. Moreover, neither Patent Owner nor Mr. Charrat can explain what design the M210H-2 label identifies. Ex. 1026, 32:17–33:3; *see* Tr. 48:13–24. To further complicate matters, the wiring diagram (Ex. 2013) that allegedly was used to confirm the accuracy of the fabrication of the Concept Electronique prototype, was labeled "Revision: 3" and dated February 5, 1999, over two months after the fabrication date of the Concept Electronique prototype and after preparation of the test report (Ex. 2012) by Mr. de Moncuit, dated "November 1998." Ex. 2013, 1. The gaps and inconsistencies in this evidence renders it insufficient corroborative evidence to demonstrate conception by Mr. Charrat or his direction of the fabrication of the prototype by Concept Electronique embodying subject matter conceived by Mr. Charrat.

Conception aside, we are not persuaded that Patent Owner has provided sufficient evidence to demonstrate that Concept Electronique fabricated a prototype according to a design provided by Mr. Charrat at Mr. Charrat's direction. We note the absence from the record of any evidence of communications between Mr. Charrat or the INSIDE team and Concept Electronique before September 10, 1998, when fabrication of the prototype allegedly began. Patent Owner has not provided any emails, letters, sketches, etc. that communicated the subject matter of the challenged claims *from* Mr. Charrat or the INSIDE team *to* Concept Electronique before Concept Electronique fabricated its prototype. Tr. 33:20–34:13. Nor do we have any testimony from Mr. Charrat or others that provides any specific information regarding the content of communications with Concept Electronique before Concept Electronique fabricated its prototype. *See* Ex. 2023 ¶ 36. Moreover, Mr. Marchand's testimony (Ex. 2024) merely states what Mr. Charrat told him about the invention, so that Mr. Marchand could draft a patent application. Mr. Marchand's testimony recounts conversations that occurred on and after January 19, 1999, and provides no *independent* and *sufficient* corroborative evidence of Mr. Charrat's activities relating to the conception of the subject matter of the challenged claims or relating to his alleged direction of the reduction of that subject matter to practice. *See* Ex. 1025, 47:20–50:9. In *Woodland Trust v. Flowertree*

Nursery, Inc., 148 F.3d 1368 (1998), the Federal Circuit found significant "the absence of any physical record to support the oral evidence," despite the "the ubiquitous paper trail of virtually all commercial activity" that normally exists "in modern times." *Id.* at 1373. As discussed above, the exhibits, on which Patent Owner relies, do not make up for the absence of such evidence.

We agree with Patent Owner that "'[c]orroboration' deals with *sufficiency* of the evidence." PO Sur-Reply 1 (emphasis added). We have considered Patent Owner's evidence, including Mr. Charrat's testimony and the allegedly corroborating exhibits discussed above, both individually and as a whole. While these exhibits may corroborate some aspects of Mr. Charrat's testimony, they do not corroborate Mr. Charrat's statements on which Patent Owner relies, namely, that Mr. Charrat conceived the subject matter of the challenged claims (Ex. 2023 ¶ 28) and communicated his design to Concept Electronique before the product actually was reduced to practice (*id.* ¶ 36). Consequently, we are not persuaded that Mr. Charrat's testimony is corroborated *sufficiently*, and we determine that Patent Owner has not met its burden of producing evidence that the subject matter of the challenged claims was conceived by Mr. Charrat and actually reduced to practice according to Mr. Charrat's design and under Mr. Charrat's direction prior to February 8, 1999, the filing date of Sears. Accordingly, we agree with Petitioner that Sears is prior art to the challenged claims of the '551 patent under 35 U.S.C. § 102(e).

C. Obviousness Challenges

1. Overview

In view of our determination that Sears is prior art to the challenged claims, we now turn to the grounds for unpatentability based on Sears, upon which we instituted this review, i.e., obviousness over Sears and over Sears and Nguyen. Dec. on Inst. 17–18. A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are "such that the subject matter[,] as a whole[,] would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations.[7] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). On this record, Petitioner demonstrates by a preponderance of the evidence that claims 1–3 and 5 are rendered obvious over Sears and over Sears and Nguyen.

2. Person of Ordinary Skill in the Art

Petitioner's declarant, Dr. Tentzeris, defines a person of ordinary skill in the art as "a person with *at least a master's degree in electrical engineering (or a substantively equivalent degree)*, in addition to two years of experience with systems that use short-range wireless communication, such as radio frequency identification (RFID) systems." Ex. 1003 ¶ 12 (emphasis added); Ex. 1031 ¶ 18; *see also* Pet. 8 (adopting this definition). Patent Owner's declarant, Dr. Alyssa B. Apsel, defines a person of ordinary skill in the art as a person having "at least *a bachelor's degree in electrical*

[7] Patent Owner does not contend in the Patent Owner Response that secondary considerations are present that would render the challenged claims patentable over the applied references. *See* Paper 11, 2–3.

engineering (or an equivalent degree), and two years of experience with short-range wireless communication systems." Ex. 2027 ¶ 13 (emphasis added); *see* PO Resp. 9, 45, 47. The proposed definitions differ primarily in level of academic achievement, with Patent Owner's declarant proposing a *lower* level.

Based on Exhibit 1003 (Attachment A) and Exhibit 2028, both Dr. Tentzeris and Dr. Apsel meet or exceed the requirements for qualification as a person of ordinary skill in the art under either definition. Moreover, neither party challenges the other party's declarant's credentials. Therefore, to the extent necessary, we adopt Dr. Apsel's definition of a person of ordinary skill in the art.

3. *Obviousness over Sears*

a. *Claim 1*

Petitioner argues that Sears discloses all of the limitations of challenged claim 1 of the '551 patent (Pet. 11–20), except that Sears teaches that each of its buffers 200A–200F "'is constructed from a [complementary metal-oxide semiconductor] CMOS hex inverter integrated circuit' that drives a load impedance that is either 'a low impedance load, such as the electromagnetic antenna 108B, or a high or infinite impedance load.'" Pet. 16 (quoting Ex. 1004, col. 4, ll. 36–42). Although the '551 patent does not discuss such CMOS hex inverter circuits, Petitioner argues that a person of ordinary skill in the art "would have understood that a tristatable CMOS inverter, as described in Sears, provides output in one of three states: logic 0, logic 1, and high impedance." Pet. 16 (citing Ex. 1003 ¶ 33; Ex. 1005, col. 1, ll. 16–18); *see also* Pet. Reply 4 ("Sears discloses that the buffers (200A-200F) are tri-statable.") (citing Ex. 1005, col. 5, ll. 4–8, col. 6, ll. 39–

46). As evidence of a person of ordinary skill in the art's understanding of CMOS hex inverter circuits, Petitioner cites to the teachings of Nguyen. *Id.* (citing Ex. 1005, Abstract, Fig. 2, col. 1, ll. 16–18); *see* Ex. 1003 ¶¶ 33–34.

Petitioner's mapping of the teachings of Sears onto the limitations of the challenged claims is persuasive. *See* Pet. 11–20; Pet. Reply 3–7. Initially, Petitioner argues that Sears's Figure 1 discloses a method for modulating the amplitude of an antenna signal of an inductive antenna circuit comprising a coil, by means of a control circuit. Pet. 12–15. Specifically, Sears's system, depicted in Figure 1, includes exciter 101 that transmits an "amplitude modulated signal" received by one or more wireless transceivers 102A, 102B. Pet. 13 (citing Ex. 1004, Abstract, col. 3, ll. 4–6, 16–20; Ex. 1003 ¶ 24).

Referring to Sears's Figure 2, Petitioner argues that Sears's exciter 101 includes modulator 104 that modulates the amplitude of a signal provided to power amplifier 106, which uses the amplitude modulated signal to drive antenna 108. Ex. 1004, Abstract; *see* Ex. 1003 ¶ 25. Antenna 108 is part of an inductive antenna circuit that includes a combination of electrostatic antenna 108A and electromagnetic antenna 108B, collectively referred to as "antenna 108." Ex. 1004, col. 3, ll. 22–24; *see* Ex. 1003 ¶ 25. Antenna 108B also includes radiating coil 211. Ex. 1004, col. 3, ll. 57–64; *see* Ex. 1003 ¶ 26; *see also* Pet. 13 (reproducing annotated Figure 2 of Sears). Radiating coil 211 is configured to "radiate RF energy" due to being driven by amplitude-modulated RF drive signal 220, provided to power amplifier 106. Ex. 1004, col. 3, ll. 57–64, col. 6, ll. 24–26; Ex. 1003 ¶ 26. "Because the antenna (108) includes a coil (211) that radiates RF energy, the antenna (108) is part of an inductive antenna circuit." Pet. 14 (citing

Ex. 1003 ¶ 26). Because Sears's amplifier modulates the amplitude of a signal and drives electromagnetic antenna 108B, causing radiating coil 211 to radiate RF energy according to the amplitude-modulated signal, Sears's amplifier modulates the amplitude of the antenna signal of an inductive antenna circuit comprising a coil by means of a control circuit. *Id.* at 14–15 (citing Ex. 1003 ¶ 28).

Further, challenged claim 1 recites that the control circuit comprises binary ports that can be set to high impedance state and with a non-zero internal resistor. Petitioner's mapping of the teachings of Sears's Figure 2 onto these limitations of the challenged claims is persuasive. Pet. 15–17. Referring again to Sears's Figure 2, Petitioner argues that Sears's power amplifier 106 includes a first set of buffers 200A–200F. Pet. 15 (reproducing annotated Figure 2 of Sears); *see* Ex. 1004, col. 3, ll. 44–46; Ex. 1003 ¶ 29. Further, each buffer 200 provides a "square wave" drive signal, resulting in aggregate waveform 503 (*see* Ex. 1004, Fig. 5) from a first set of buffers 200A–200F that drives antenna 108 (*see id.* at col. 4, ll. 19–23). This square-wave drive signal varies from a low level (e.g., zero volts) to a high level (which depends on RF adjustable power supply 399). *Id.* at col. 6, ll. 55–60, Fig. 3; Ex. 1003 ¶ 30; *see* Pet. 15; PO Resp. 36–37. Because power amplifier 106 includes buffers 200A–200F, each of which provides a square-wave output signal, either at a high level or low level, Petitioner argues that Sears's control circuit comprises binary ports. Ex. 1003 ¶¶ 30, 31.

Patent Owner disagrees and contends that Sears discloses power modulation by varying "the duty cycle of the oscillations of the carrier signal sent to power amplifier 106." PO Resp. 40 (citing Ex. 1004, col. 7, ll. 4–6).

Specifically, Patent Owner contends that "[t]his method of modulating the power does not involve 'setting' the buffers to any particular value; it only involves changing the duty cycle of the input they receive." *Id.* (citing Ex. 2027 ¶ 58). Nevertheless, because Sears's Figure 5 depicts a square wave provided by buffers 200A–200F, we are persuaded that Sears teaches a control circuit comprising binary ports or teaching or suggesting binary ports. *See* Ex. 1003 ¶¶ 30, 31.

In addition, Petitioner argues that buffers 200A–200F are "tristatable" because "buffers (200A–200F) are used to yield (1) a high level output, (2) a low level output, or (3) complete disconnection that amounts to a high impedance state." Pet. 16 (citing Ex. 1004, col. 5, ll. 4–8, col. 6, ll. 39–46; Ex. 1003 ¶¶ 32, 33). Moreover, each buffer 200 may be "constructed from a CMOS hex inverter integrated circuit" that drives a load impedance that is either "a low impedance load, such as the electromagnetic antenna 108B, or a high or infinite impedance load." *Id.* at 16 (quoting Ex. 1004, col. 4, ll. 36–42). Petitioner discusses the application of Sears's disclosure of a CMOS hex inverter circuit and why a person of ordinary skill in the art would understand that this circuit teaches the control circuit recited in the challenged claims. Pet. 15–16; *see* Ex. 1003 ¶ 33 ("A [person of ordinary skill in the art] would have understood that a tristatable CMOS inverter, as described in Sears, provides output in one of three states: logic 0, logic 1, and high impedance."). Consequently, we are persuaded that Petitioner has identified sufficiently "the scope and content of the prior art . . . ; differences between the prior art and the claims at issue . . . ; and the level of ordinary skill in the art." *Graham*, 383 U.S. at 17.

Claim 1 further recites the step of "setting the ports providing the electric supply of the antenna circuit to '1', to supply the antenna circuit at full power level." Petitioner argues that, as described above, each of buffers 200A–200F may be *disconnected* selectively from the other buffers to vary the amplitude of the signal that drives antenna 108. Pet. 18 (citing Ex. 1004, col. 2, ll. 40–43, col. 2, ll. 60–65; Ex. 1003 ¶ 37). Thus, the maximum possible drive signal to antenna 108 may be achieved when each of buffers 200A–200F are connected and when each is configured to provide a high output power level to antenna 108. *Id.* (citing Ex. 1004, col. 5, ll. 30–33; Ex. 1003 ¶ 38). Petitioner concludes that "[c]ontrolling the buffers (200A-200F) to provide a high output power level represents setting the buffers (200A-200F) to 1." *Id.* (citing Ex. 1003 ¶ 38).

Patent Owner disagrees and contends instead that the output of each of the buffers simply tracks its input. PO Resp. 40. Consequently, Patent Owner contends that none of Sears's buffers 200A–200F is placed into a "1" state, but each of buffers 200A–200F simply outputs whatever input it receives. *Id.* (citing Ex. 2027 ¶ 56). Further, Patent Owner contends that Sears discloses three possible modes of operation: (1) power modulation by varying "the duty cycle of the oscillations of the carrier signal sent to power amplifier 106" (*id.* (citing Ex. 1004, col. 7, ll. 4–6)); (2) power modulation by varying the voltage of a variable power supply, e.g., power supply 399 (*id.* at 41 (citing Ex. 1004, col. 6, ll. 36–38)); and (3) antenna power modulation by varying the number of buffers driving the antenna (*id.* (citing Ex. 1004, col. 6, ll. 39–40)).

Although Patent Owner contends that none of these methods teaches the "setting" step of claim 1, Dr. Tentzeris testifies that this third mode of operation could be accomplished by connecting and disconnecting at least some of the buffers from the antenna circuit. Pet. 16 (citing Ex. 1003 ¶ 34); *see* PO Resp. 41. Sears teaches that the number of buffers driving the inductive antenna may be increased or decreased to vary the power delivered to the antenna and, consequently, to modulate the antenna signal. Pet. Reply 5 (citing Ex. 1004, col. 5, ll. 1–8); *see* Pet. 12 (citing Ex. 1004, Abstract, col. 2, ll. 62–64, col. 5, ll. 4–8, col. 6, ll. 5–46; Ex. 1003 ¶ 27); Ex. 1031 ¶ 42; Ex. 2046, 35:15–37:20. Patent Owner's declarant, Dr. Apsel, acknowledges that Sears teaches antenna power modulation by varying the number of buffers driving and that

> disconnecting the buffers *could arguably be viewed as placing them [in] a high impedance state*, [but] nothing about this disclosure suggests electrically powering the antenna by "at least two ports of the control circuit," and then setting any of the buffers to "1" to supply the antenna circuit at full power level.

PO Resp. 41 (emphasis added) (quoting Ex. 2027 ¶ 60). We are persuaded that a person of ordinary skill in the art would have understood that Sears teaches the recited "setting" step, based on Petitioner's arguments and the testimony of both Dr. Tentzeris and Dr. Apsel. Pet. 12; Pet. Reply 4–5; Ex. 1003 ¶ 34; Ex. 2027 ¶ 60; *see* PO Resp. 41.

Claim 1 further recites the step of "changing the state of at least one of the ports providing the electric supply of the antenna circuit, to modulate the amplitude of the antenna signal." Referring to Sears's Figure 7, Petitioner argues that Sears teaches changing one or more of buffers 200A–200F (or their components 306–310) from a connected state to a disconnected state to modulate the amplitude of the oscillating waveform of the carrier signal. Pet. 19–20 (reproducing annotated Figure 7 of Sears); *see* Ex. 1003 ¶ 42. As described with reference to other means of reducing the electric supply to Sears's antenna circuit (*see* Ex. 1004, col. 7, ll. 13–19), "[a]mplitude 702 is the reduced amplitude representing a part of some information that is transmitted by the antenna" (*id.*; *see id.* at col. 7, ll. 23–25; Ex. 1003 ¶¶ 43, 44). Patent Owner does not contend that Sears does not teach this limitation. *See* PO Resp. 41; Pet. Reply 7. Therefore, based on Petitioner's arguments and evidence, we also are persuaded that a person of ordinary skill in the art would have understood that Sears teaches the recited "changing" step.

b. Claim 2

Claim 2 recites the method of claim 1, "in which the ports providing the electric power supply of the antenna circuit are set to '0', for 100% modulation of the antenna signal." Petitioner argues that Sears describes modulating the amplitude of the drive signal to antenna 108. Pet. 20 (citing Ex. 1004, Abstract, col. 6, ll. 39–46); *see* Ex. 1003 ¶ 45. In particular, Sears teaches that "[i]n order to be backward compatible with an older RF system, the alternate modulation percentage must be nearly 100%." *Id.* (quoting Ex. 1004, col. 7, ll. 32–35). Moreover, as noted above, each of buffers 200A–200F has a low output level (e.g., ground) that can be set to a low level output by coupling the negative field effect transistor source in each of the inverters in buffer 200 to ground. Pet. 20 (citing Ex. 1004, col. 5, ll. 9–38); *see* Ex. 1003 ¶ 46. Consequently, Petitioner argues that

> Because each of the buffers (200A–200F) can output a low output level corresponding to ground, and that the minimum aggregate output level of all of the buffers (200A–200F) is zero volts, Sears sets the ports providing the electric power supply of the antenna circuit to "0", for 100% modulation of the antenna signal.

Pet. 21 (citing Ex. 1003 ¶ 47).

Sears teaches that the 100% modulation "can be provided through the power antenna signal 417 and NAND gate 416." Ex. 1004, col. 7, ll. 34–36. As argued above, amplitude modulation may be achieved by varying the number of buffers 200A–200F, and each of these buffers can provide a low level equal to ground (i.e., zero volts). Pet. 21 (citing Ex. 1004, col. 6, ll. 56–58). Thus, Petitioner argues that a person of ordinary skill in the art would have understood that, to achieve the "100% modulation," both or all of the buffers 200A–200F supplying power would provide a low level output and drive antenna 108 with an aggregate drive signal of zero volts. *Id.* (citing Ex. 1004, col. 6, ll. 56–58); *see* Ex. 1003 ¶ 48.

Patent Owner disagrees and contends that Sears does not achieve 100% modulation by "setting" buffers. PO Resp. 42–43. Instead, Sears explains that 100% modulation "can be provided through the power antenna signal 417 and NAND gate 416." Ex. 1004, col. 7, ll. 32–35, Fig. 4.

Sears's Figure 4 is reproduced below:

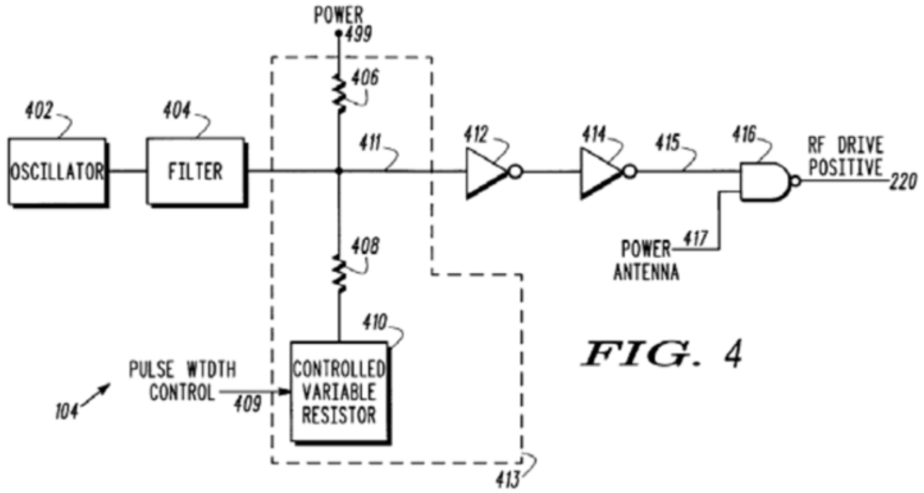
POWER
499
406
402
404
OSCILLATOR
FILTER
411
412
414
415
416
RF DRIVE
POSITIVE
220
408
POWER
ANTENNA
417
410
PULSE WIDTH
CONTROL
409
104
CONTROLLED
VARIABLE
RESISTOR
413

FIG. 4

Figure 4 is a block diagram of a modulator circuit for use with a power amplifier in accordance with an embodiment of Sears's invention. *Id.* at col. 2, ll. 20–23. The modulator circuit of Figure 4 depicts that power antenna signal 417 may be used to drive the output of NAND gate 416 to a low-level when 100% modulation is desired. *Id.* at col. 6, ll. 23–25. Specifically, Patent Owner contends that "[w]hen power antenna signal 417 is low, the output of NAND gate 416 stays high without oscillations thereby attenuating the power output by the antenna 108." *Id.* at col. 6, ll. 29–32; *see* PO Resp. 42–43. Thus, Patent Owner concludes that "by providing a constant low voltage to the power input 417 of the NAND gate, the output of the NAND gate will always be high and the signal is attenuated." PO Resp. 43.

According to Dr. Apsel, "Sears does not disclose achieving 100% modulation of the antenna signal by setting the ports providing the electric power supply to '0,' or by manipulation of buffers." Ex. 2027 ¶ 63. Nevertheless, Dr. Apsel testifies that "Sears describes 100% modulation *simply by removing the input signal* to the buffers." *Id.* (emphasis added).

Consistent with Dr. Apsel's testimony, Petitioner notes that "Sears teaches that the 'RF Drive Positive signal 220 [is an] input into buffers

200A-200F." Pet. Reply 6 (citing Ex. 1004, col. 4, ll. 15–20, Figs. 2, 4); *see* Pet. 14. Sears's Figure 2, as annotated by Petitioner, is reproduced below:

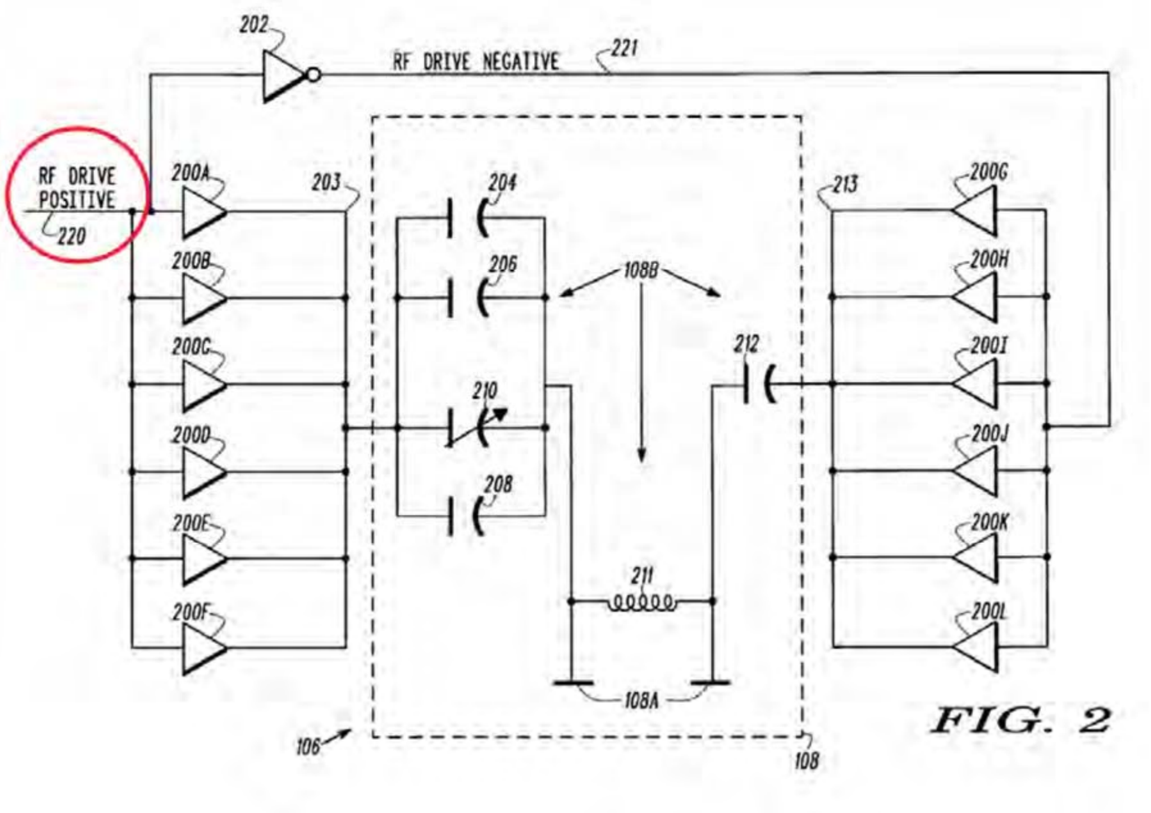
202
RF DRIVE NEGATIVE
221
RF DRIVE POSITIVE
220
200A
200B
200C
200D
200E
200F
203
204
206
108B
210
208
211
212
213
108A
106
108
200G
200H
200I
200J
200K
200L

FIG. 2

Figure 2 is a schematic diagram of a power amplifier with associated circuitry in accordance with an embodiment of the Sears invention.

Ex. 1004, col. 2, ll. 14–16. Thus, referring to Sears's Figure 4, the output of NAND gate 416 is "RF Drive Positive 220," which is the input to buffers 200A–200F, as depicted in Sears's Figure 2. Because each buffer 200A–200F is a tristate inverter (Ex. 1004, col. 4, ll. 36–42, Fig. 2), if, as Patent Owner asserts, the input to buffers 200A–200F is always high during a 100% modulation, *the output of buffers 200A–200F is always low* (Ex. 1031 ¶ 50; *but see* Paper 47, 6). Accordingly, Sears's buffers 200A–200F are set to zero when 100% modulation is performed, as recited in claim 2. *Id.* Therefore, after considering both parties' arguments and evidence, including the testimony of Dr. Tentzeris and Dr. Apsel, we are persuaded that a person of ordinary skill in the art would have understood that Sears teaches the recited limitations of claim 2.

c. Claims 3 and 5

Petitioner maps in detail how the additional limitations of dependent claims 3 and 5 are taught or suggested by Sears. Pet. 21–24. Patent Owner does not contend that Sears does not teach these additional limitations. *See* PO Resp. 41; Pet. Reply 7. We agree with and adopt Petitioner's analysis of Sears and mapping of Sears on the additional limitations of claims 3 and 5, as set forth in the Petition.

For the reasons set forth above, Petitioner demonstrates by a preponderance of the evidence that claims 1–3 and 5 are unpatentable over Sears.

4. Obviousness over Sears and Nguyen

As noted above, Petitioner argues that Sears discloses all of the limitations of the challenged claims, with the exception of the operation of a control circuit recited in challenged claim 1. Pet. 24. Nevertheless, Petitioner argues that Nguyen teaches "a tristatable buffer of the type referenced by Sears, and expressly acknowledges that a tristatable buffer can be set to '1,' '0,' or a high impedance state." *Id.* (citing Ex. 1005, Abstract, col. 1, ll. 10–18); Pet. Reply 7. Petitioner relies on the teachings of Nguyen to provide more explicit detail of this feature. Pet. 24. In particular, Nguyen teaches "an output line of a tristate device typically provides one of three states: logic 0, logic 1, and high impedance." Pet. Reply 4 (quoting Ex. 1005, Abstract); *see id.* at Fig. 2, col. 1, ll. 16–18; Ex. 1031 ¶ 41.

Initially, Patent Owner contends that Nguyen fails to remedy the deficiencies in Sears and that Nguyen only teaches a tristatable inverter. PO Resp. 43–44. In particular, Patent Owner contends that Nguyen is directed simply to inverters and not to any sort of radio-frequency device and that Nguyen does not teach much more than inverters. *Id.* at 44. Consequently, Patent Owner contends that Nguyen fails to teach the "setting" step, as recited in claim 1, or "set[ting] to '0', for 100% modulation of the antenna signal," as recited in claim 2. *Id.* As discussed above, however, Petitioner argues, and we agree, that Sears, rather than Nguyen, teaches these limitations. *See supra* Sections II.C.3.a. and b.

Petitioner further argues that a person of ordinary skill in the art would have had reason to combine the teachings of Sears and Nguyen because "Nguyen is configured to minimize switching delay in 'integrated circuit devices.'" Pet. 25 (citing Ex. 1005, col. 1, ll. 6–9; Ex. 1003 ¶ 55). Alternatively, Petitioner contends that a person of ordinary skill in the art would have understood that Nguyen's device merely would have been the substitution of a device operating in the same manner as Sears's CMOS hex inverter circuit. *Id.*; *see* Ex. 1003 ¶ 55; *see also KSR*, 550 U.S. at 416 ("The Court recognized that when a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.").

Patent Owner contends that a person of ordinary skill in the art would not have had reason to combine the teachings of Sears and Nguyen because to do so would be contrary to Sears's goals. PO Resp. 45–47. In particular, Patent Owner contends that "Sears seeks to construct a power amplifier that is 'readily mass manufactured, power efficient, flexible and compact in size.'" *Id.* at 46 (quoting Ex. 1004, col. 2, ll. 6–8). Further, Sears explains that one of the advantages of its device is that it "uses a minimum number of low power devices." Ex. 1004, col. 7, ll. 52–55. Patent Owner contends, however, that Nguyen's inverters are complicated and include numerous additional components. Ex. 2027 ¶ 68. Despite their complexity, Dr. Apsel acknowledges that the inverters designed by Nguyen "do have certain advantages." *Id.* Dr. Apsel does not testify whether a person of ordinary skill in the art would have found that any of those advantages outweigh the disadvantage of greater complexity. *Id.* In particular, Dr. Apsel testifies that

> It is possible, for instance, that a buffer design relying on Nguyen's inverters would provide enough power to obviate the need for the parallel buffers in Sears' circuit. Without knowing more design parameters (e.g., internal resistances, conductances, etc.), it would not be readily apparent that Nguyen's inverters could be used in Sears' circuit.

Id. ¶ 69 (emphasis added). Thus, Dr. Apsel acknowledges that it is unclear whether Nguyen's inverter would increase or reduce the complexity of the Sears circuitry. Moreover, Dr. Apsel does not address whether the combination of the teaching of Sears and Nguyen would fail to achieve any of the other goals listed by Sears.

Therefore, we remain persuaded that either Nguyen's detailed description of the tristate operation of its inverter or the substitution of one of Nguyen's inverters for an equivalent device would have been sufficient reason for a person of ordinary skill in the art to combine the teachings of Sears and Nguyen to achieve the subject matter recited in the challenged claims.

Patent Owner only disputes the combination of the teachings of Sears and Nguyen, as those teachings are applied to claim 1. Petitioner relies on Sears to supply the additional limitations of dependent claims 2, 3, and 5. *See* Pet. 21–24. For the reasons set forth above with respect to Sears, we agree with and adopt Petitioner's analysis with respect to claims 2, 3, and 5.

For the reasons set forth above, Petitioner demonstrates by a preponderance of the evidence that claims 1–3 and 5 are unpatentable over Sears and Nguyen.

D. Motion to Exclude Evidence

Patent Owner filed a Motion to Exclude Evidence (Paper 49, "Mot. to Excl."). In particular, Patent Owner seeks to exclude (1) paragraphs 128–134, 141–188, and 190–200 of Exhibit 1031, "under Fed. R. Evid. 401 as not relevant to issues at trial because they were not cited in the Petitioner's Reply" (Mot. to Excl. 1–2); and (2) paragraphs 67–85 and 120–127 of Exhibit 1031, "under Fed. R. Evid. 602 because Dr. Tentzeris has no personal knowledge of the facts discussed in these paragraphs nor is he an expert regarding them" (*id.* at 2–6). Petitioner filed an Opposition to Patent Owner's Motion to Exclude Evidence (Paper 53, "Opp. to Mot."), and Patent Owner filed a Reply to Petitioner's Opposition to Patent Owner's Motion to Exclude Evidence (Paper 54, "Reply to Opp.").

With respect to its first objection, Patent Owner contends that "[n]owhere in the record does Petitioner rely on paragraphs 128–134, 141–188, and 190–200 of the Reply Declaration or identify with any particularity how these paragraphs are relevant to the issues in this proceeding." Mot. to Excl. 1. Because Petitioner does not rely on these paragraphs, Patent Owner contends that these paragraphs cannot be relevant under Fed. R. Evid. 401 to

Petitioner's Reply to the arguments or evidence presented in the Patent Owner Response. *Id.* at 1–2. Petitioner disagrees and argues that

> [E]ach paragraph is relevant to issues in this case because: (1) ¶¶128–134, which respond to PO's actual reduction to practice evidence, are referenced in an unchallenged paragraph of Dr. Tentzeris' declaration (¶66) and discuss evidence also discussed in other relevant paragraphs (¶¶66 and 77); and (2) ¶¶141–188 and ¶¶190–199 address specific evidence raised by PO in its PO Response. ¶200 is simply Dr. Tentzeris' concluding paragraph.

Opp. to Mot. 2. Patent Owner replies that Petitioner is merely seeking to place "the burden on the Board to sift through the Reply and accompanying Declaration to determine which paragraphs were properly cited and relied on and then determine the appropriate weight." Reply to Opp. 1.

We agree with Petitioner that Patent Owner's objections to paragraphs 128–134, 141–188, and 190–200 of Exhibit 1031 go to the weight to be given this evidence, rather than to its admissibility. The Board, sitting as a non-jury tribunal with administrative expertise, is well positioned to determine and assign appropriate weight and/or relevance to evidence presented. *See Gnosis S.p.A. v. S. Ala. Med. Sci. Found.*, Case IPR2013-00118, slip op. at 43 (PTAB June 20, 2014) (Paper 64). Therefore, we *deny* Patent Owner's request to exclude these paragraphs.

With respect to its second objection, Patent Owner contends that, in paragraphs 67–85 and 120–127 of Exhibit 1031,

> Petitioner has offered Dr. Tentzeris as an expert on technical issues and not as to the facts leading up to the development of the M210H device at INSIDE. Dr. Tentzeris is not an expert regarding these facts and possesses no personal knowledge of them. . . . Dr. Tentzeris' opinions regarding these facts is not based on his technical expertise or his own personal knowledge. Instead, Petitioners use the Reply Declaration to give the

> appearance of expert authority to what is otherwise a meritless attorney argument.

Mot. to Excl. 2–3. In particular, Patent Owner contends that paragraphs 67–85 of Exhibit 1031 contain unfounded speculation on the dates of exhibits and are not based on Dr. Tentzeris's personal knowledge. *Id.* at 3–4. Further, Patent Owner contends paragraphs 120–127 of Exhibit 1031 "contain unfounded speculation regarding software development for the M210H Prototype and are not based on Dr. Tentzeris' personal knowledge or expertise." *Id.* at 4–6 (emphasis omitted). Because we do not rely on paragraphs 67–85 and 120–127 of Exhibit 1031 in reaching our decision here, we *dismiss* Patent Owner's Motion to Exclude Evidence, with respect to these paragraphs, as moot.

III. CONCLUSION

Petitioner demonstrates by a preponderance of the evidence that claims 1–3 and 5 of the '551 patent are unpatentable.

IV. ORDER

For the reasons given, it is

ORDERED that claims 1–3 and 5 of the '551 patent are unpatentable as

1. rendered obvious over Sears; and
2. rendered obvious over Sears and Nguyen;

FURTHER ORDERED that Patent Owner's Motion to Exclude Evidence (Paper 49) is *denied* with respect to paragraphs 128–134, 141–188, and 190–200 of Exhibit 1031 and *dismissed* as moot with respect to paragraphs 67–85 of Exhibit 1031; and

FURTHER ORDERED that, because this is a final decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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(12) **United States Patent**
Charrat

(10) **Patent No.: US 6,700,551 B2**
(45) **Date of Patent: Mar. 2, 2004**

(54) **ANTENNA SIGNAL AMPLITUDE MODULATION METHOD**

(75) Inventor: **Bruno Charrat**, Aix en Provence (FR)

(73) Assignee: **Inside Technologies**, Saint Clement les Places (FR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 177 days.

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(22) Filed: **Sep. 25, 2001**

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(30) **Foreign Application Priority Data**

Mar. 25, 1999 (FR) 99 04108

(51) **Int. Cl.**^{7} **H01Q 1/36**

(52) **U.S. Cl.** **343/895**; 235/487; 235/492

(58) **Field of Search** 343/895, 745, 343/749; 235/440, 487, 492; 340/872.31

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,003,122 A		10/1961	Gerhard	332/9
4,490,854 A		12/1984	Bensussan et al.	455/118
4,529,950 A		7/1985	Chazenfus et al.	332/9
4,818,855 A	*	4/1989	Mongeon et al.	235/440
5,170,046 A	*	12/1992	Kusakabe	235/492
5,345,231 A	*	9/1994	Koo et al.	340/870.31
6,540,147 B2	*	4/2003	Charrat	235/492

FOREIGN PATENT DOCUMENTS

DE	196 27 640	9/1997
EP	0 693 843	1/1996

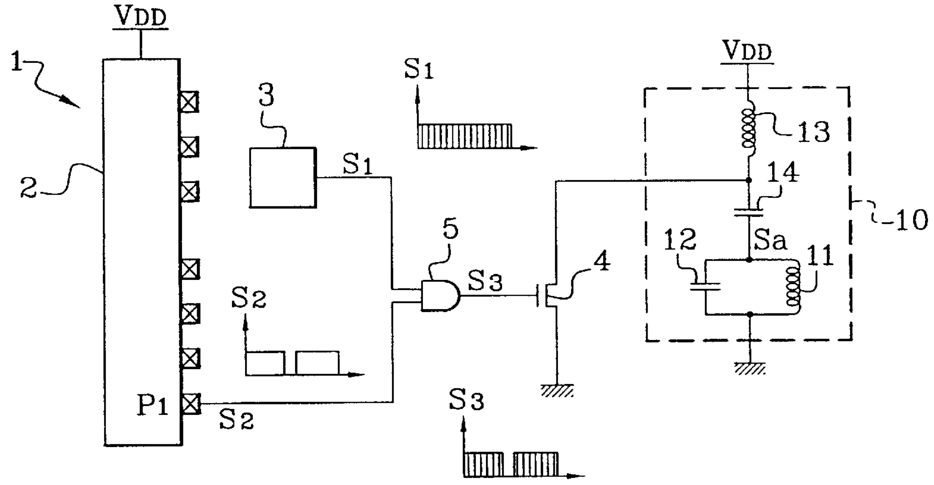
* cited by examiner

Primary Examiner—Tan Ho
(74) *Attorney, Agent, or Firm*—Patterson, Thuente, Skaar & Christensen, P.A.

(57) **ABSTRACT**

A method for modulating the amplitude of an antenna signal applied to an inductive-type antenna circuit by a control circuit having binary ports that can be set to high impedance and with a non-zero internal resistor. The signal providing the electric power supply of the antenna circuit is delivered by at least two ports of the control circuit, and the amplitude of the antenna signal is modulated by changing the output state of at least one of the ports. Particularly applied to contactless smart card readers.

8 Claims, 5 Drawing Sheets



HTC Exhibit 1001

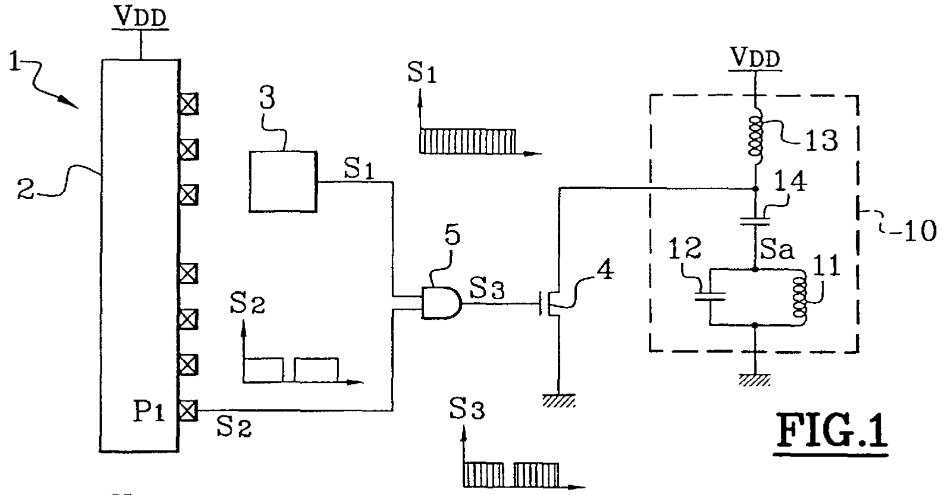

VDD
1
2
3
S1
S1
5
S3
4
S2
P1
S2
S3
VDD
13
14
Sa
12
11
10

FIG.1

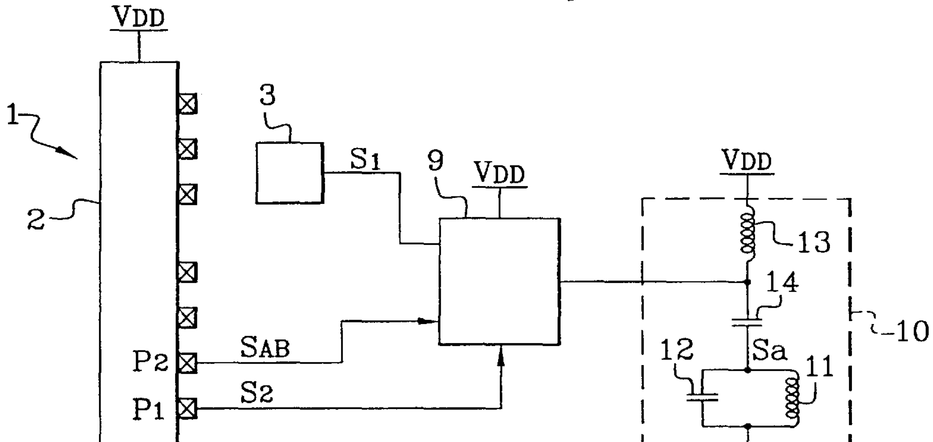

VDD
1
2
3
S1
9
VDD
P2
SAB
P1
S2
VDD
13
14
Sa
12
11
10

FIG.2

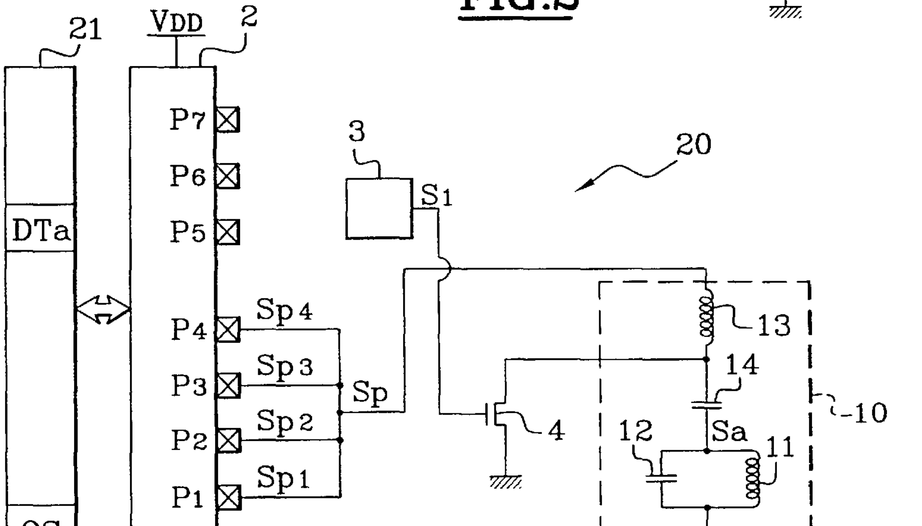

21
VDD
2
DTa
OS
P7
P6
P5
P4
P3
P2
P1
Sp4
Sp3
Sp2
Sp1
Sp
3
S1
20
4
13
14
Sa
12
11
10

FIG.3

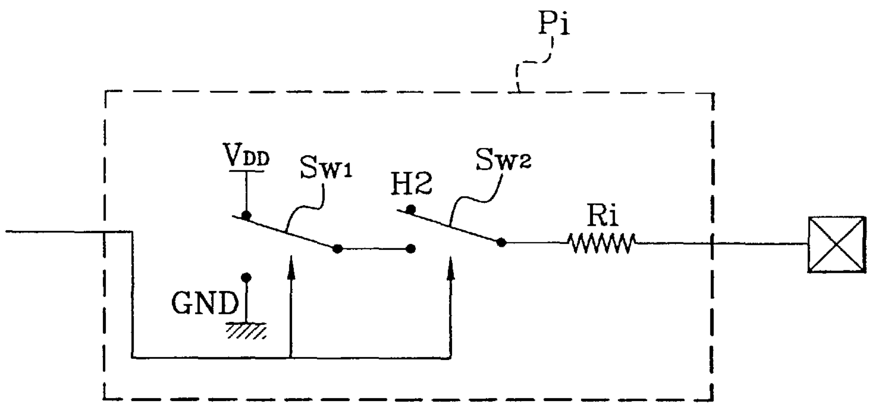

Pi
VDD
Sw1
H2
Sw2
Ri
GND

FIG.4

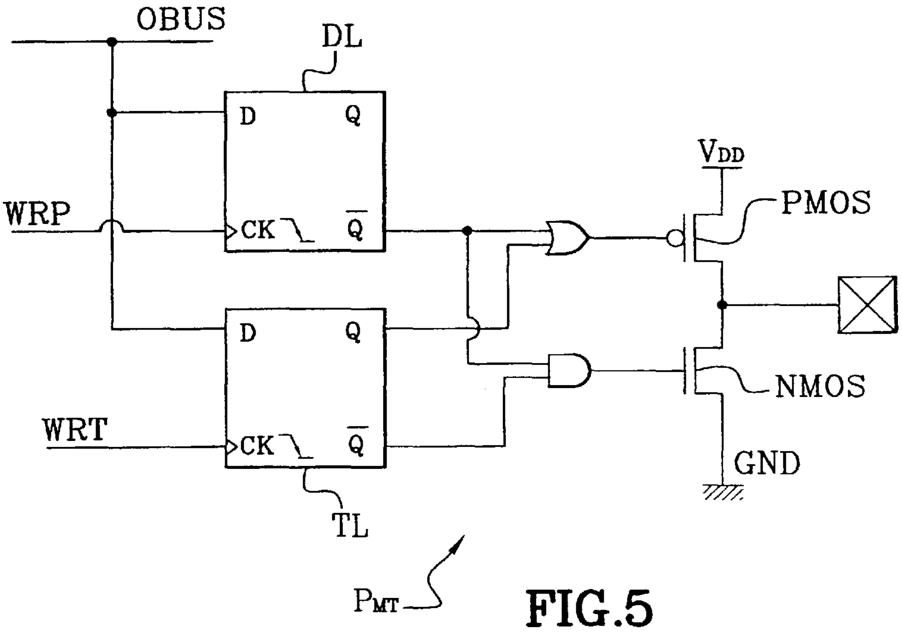
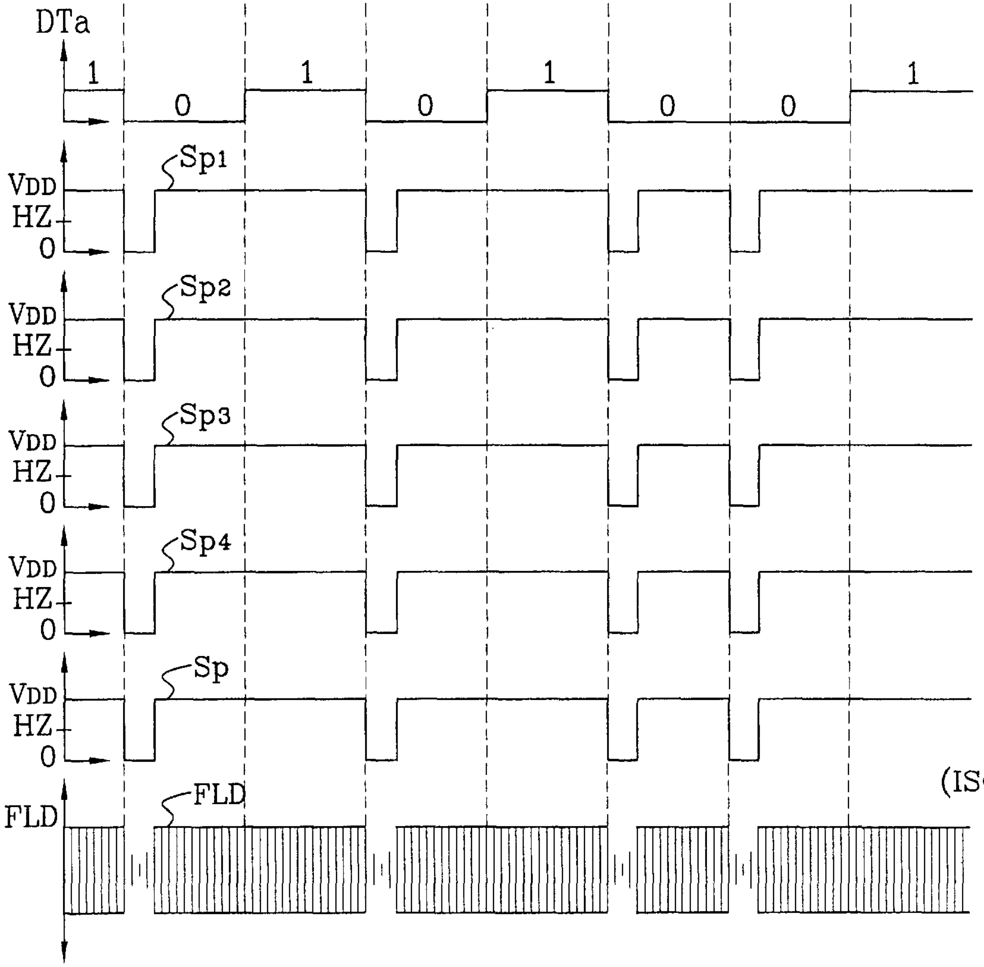

OBUS
DL
D
Q
WRP
CK
Q
VDD
PMOS
D
Q
NMOS
WRT
CK
Q
GND
TL
PMT

FIG.5

FIG.6A
FIG.6B
FIG.6C
FIG.6D
FIG.6E
FIG.6F
FIG.6G


DTa
1
0
1
0
1
0
0
1
Sp1
Sp2
Sp3
Sp4
Sp
VDD
HZ
0
FLD

(ISO 1444-2/A)

HTC Exhibit 1001

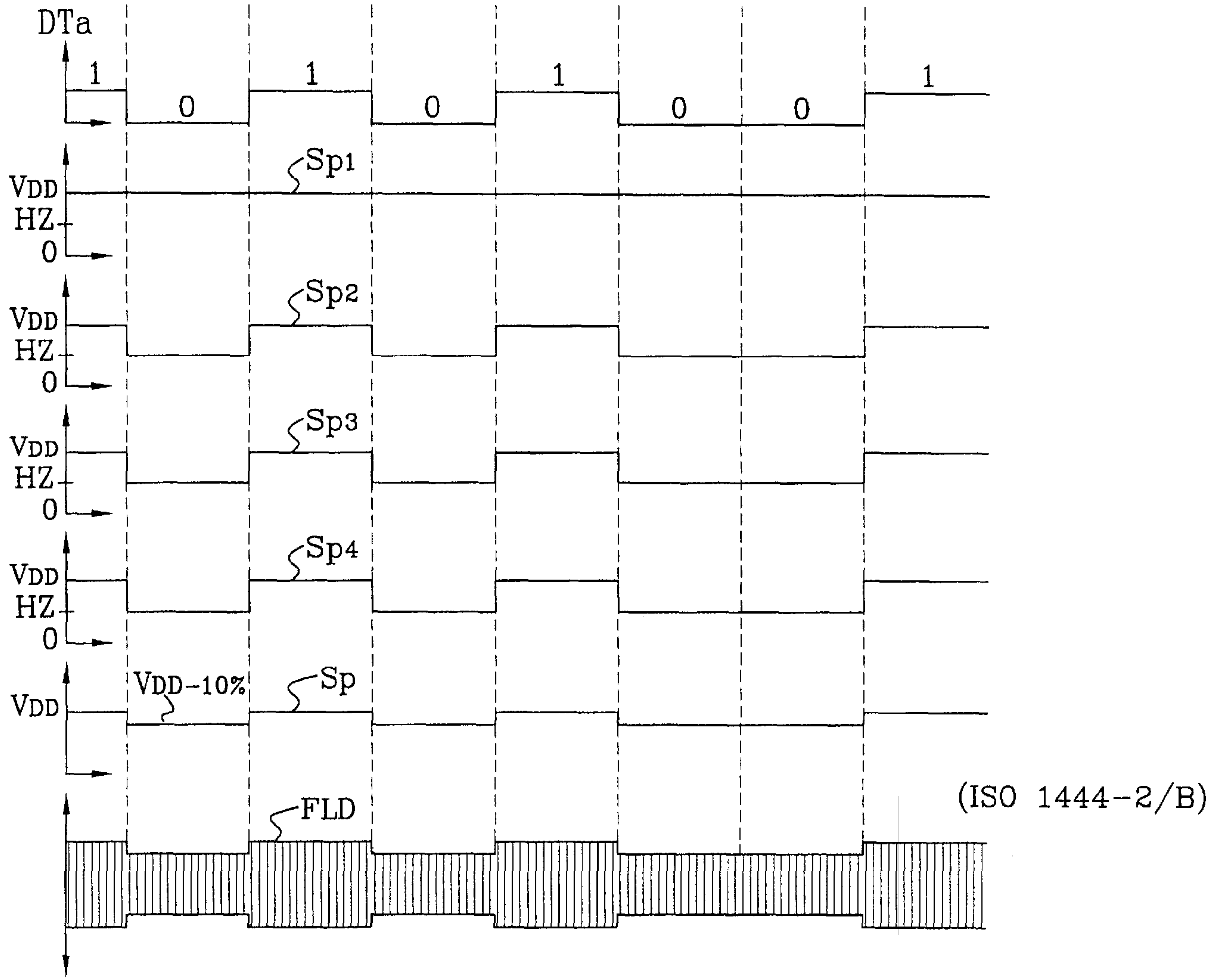

DTa
1
0
1
0
1
0
0
1
VDD
HZ
0
Sp1
Sp2
Sp3
Sp4
VDD-10%
Sp
FLD
(ISO 1444-2/B)

FIG.7A

FIG.7B

FIG.7C

FIG.7D

FIG.7E

FIG.7F

FIG.7G

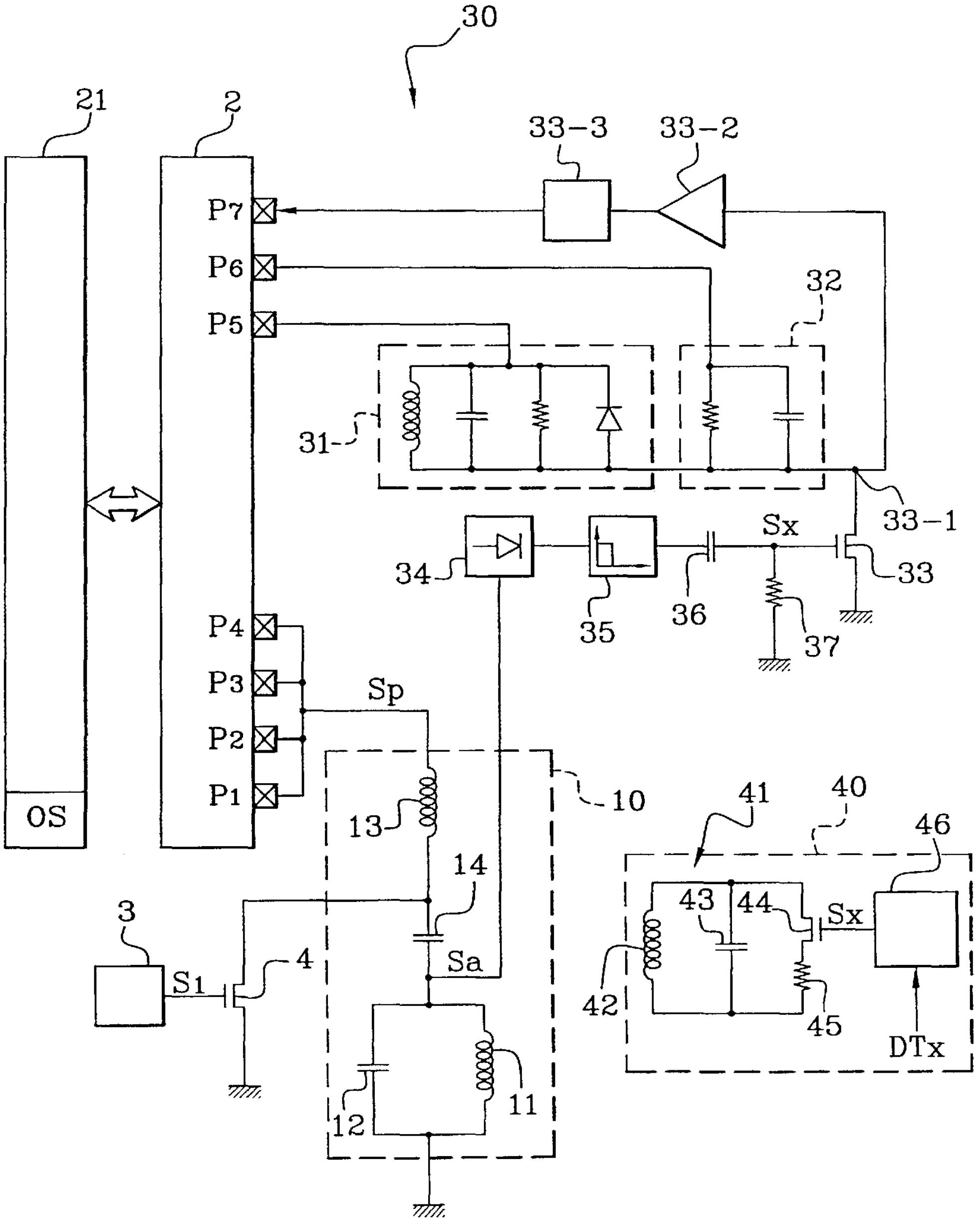

30
21
2
33-3
33-2
P7
P6
P5
32
31
33-1
Sx
34
35
36
37
33
P4
P3
P2
P1
Sp
OS
10
13
41
40
46
14
3
43
44
Sx
4
S1
Sa
42
45
DTx
12
11

FIG.8

ANTENNA SIGNAL AMPLITUDE MODULATION METHOD

This is a continuation of application PCT/PR60/00712, filed on Mar. 22, 2000.

BACKGROUND OF THE INVENTION

The present invention relates to an inductive coupling data transmission device, comprising an inductive antenna circuit driven by an antenna signal and a control circuit comprising binary ports that can be set to high impedance and that have a non-zero internal resistor.

In particular, the present invention relates to devices designed to exchange data with portable electronic objects comprising a contactless integrated circuit, such as contactless smart card readers, electronic label scanners, electronic badge scanners, . . .

According to draft standards ISO 14443-2/A or 14443-2/B, hereinafter referred to as "ISO/A" and "ISO/B", the antenna coil of a contactless integrated circuit reader is driven by an antenna signal oscillating at a frequency of 13.56 MHz. The data transmission to the integrated circuit is carried out by modulating the amplitude of the antenna signal, with a modulation depth of 100% in the case of standard ISO/A or 10% in the case of standard ISO/B.

FIG. **1** represents a classical data transmission device **1** comprising a microprocessor **2**, an oscillator **3**, a modulation transistor **4** and a resonant-type antenna circuit **10**. The antenna circuit **10** comprises an antenna coil **11** in parallel with a capacitor **12** and receives a direct supply voltage VDD through an inductor **13** and an insulation capacitor **14**. The modulation transistor **4** is connected to the terminals of the coil **11** by means of the insulation capacitor **14**. The oscillator **3** delivers a signal S1 oscillating at 13.56 MHz and the microprocessor **2** delivers an amplitude modulation binary signal S2 to a port P1. Signals S1 and S2 are applied to an AND gate **5** the output of which delivers a modulation signal S3 applied to the gate of transistor **4**, which is shown in FIG. **1**. The antenna signal Sa passing through the coil **11** is the image of signal S3.

SUMMARY OF THE INVENTION

The advantage of this data transmission device is that the structure is relatively simple but it only allows the amplitude of the antenna signal to be modulated at 100% (ISO/A). To obtain a 10% modulation of the antenna signal Sa (ISO/B), the device becomes more complex and other elements must be added to it.

The device becomes even more complex if it is to be compatible with standards ISO/A and ISO/B so as to be able to transmit data to two different types of integrated circuits. In this case, as shown by FIG. **2**, the modulation switch **4** is replaced by a modulation circuit **9** represented in block form. The modulation circuit **9** receives signals S1, S2 and a signal S_{AB} delivered by a port P2 of the microprocessor, allowing the type of modulation required to be selected. To achieve this modulation circuit **9** various electric and/or electronic components are required.

Therefore, one object of the present invention is to provide a data transmission device of the type described above that can modulate the antenna signal with a modulation depth of less than 100% while being simple in structure and inexpensive to produce.

One more particular object of the present invention is to provide a data transmission device that can be multi-purpose and that can modulate the antenna signal with several modulation depths, particularly modulation depths of 10% and 100%.

The present invention also relates to receiving data sent by a contactless integrated circuit by the charge modulation method. In this case, the coil **11** of the data transmission device described above receives a charge modulation signal by inductive coupling, that is mixed with the antenna signal Sa. The charge modulation signal must be extracted from the antenna signal Sa and demodulated by adequate filtering before being decoded. Known demodulation and filtering systems are inconvenient in that they are complex if they are to be compatible with several charge modulation protocols, particularly those stipulated by standards ISO/A and ISO/B.

Thus, another object of the present invention is to provide a demodulation device that is compatible with several charge modulation protocols, while being simple in structure and inexpensive to produce.

To achieve these objects, the present invention provides a method for modulating the amplitude of the antenna signal of an inductive antenna circuit comprising a coil, by means of a control circuit comprising binary ports that can be set to high impedance state and with a non-zero internal resistor, a method in which the antenna circuit is electrically powered by at least two ports of the control circuit, and comprising the steps of: setting the ports providing the electric supply of the antenna circuit to "1", to supply the antenna circuit at full power level, and changing the state of at least one of the ports providing the electric supply of the antenna circuit, to modulate the amplitude of the antenna signal.

According to one embodiment, the ports providing the electric power supply of the antenna circuit are set to "0" for a 100% modulation of the antenna signal.

According to one embodiment, at least one port is set to high impedance state while the other port or ports are maintained on "1" for a modulation of the antenna signal amplitude of less than 100%.

According to one embodiment, the antenna signal is also modulated in frequency by switch means connected to the terminals of the coil and controlled by an alternative signal.

The present invention also relates to an inductive coupling data sending device, comprising an inductive-type antenna circuit comprising a coil through which an antenna signal passes, a control circuit of the antenna circuit comprising binary ports that can be set to high impedance and with a non-zero internal resistor, in which the antenna circuit is electrically powered by at least two ports of the control circuit, and the control circuit is arranged to modulate the amplitude of the antenna signal in compliance with the method of the present invention.

According to one embodiment, the device comprises an oscillator delivering an alternative signal and switch means controlled by the alternative signal, arranged at the terminals of the antenna coil to modulate the frequency of the antenna signal.

The present invention also relates to a data send/receive device of the type described above, comprising a band-pass filter and a low-pass filter arranged to receive a charge modulation signal present in the antenna signal on a first terminal, and each connected by their other terminal to a port of the control circuit.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the present invention shall be presented in greater detail in the following description of a data transmission method and device according to the present invention, and of a data receiving device according to the present invention, in relation with the following figures:

FIGS. **1** and **2** described above are wiring diagrams of classical induction data transmission devices,

FIG. **3** is the wiring diagram of a data transmission device according to the present invention,

FIG. **4** is the wiring diagram of a microprocessor port,

FIG. **5** is the logical diagram of a microprocessor port,

FIGS. **6**A to **6**G represent various signals occurring in the device in FIG. **3**, according to a first aspect of the method of the present invention,

FIGS. **7**A to **7**G represent various signals occurring in the device in FIG. **3**, according to a second aspect of the method of the present invention, and

FIG. **8** is the wiring diagram of a data send/receive device according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First aspect of the present invention: antenna signal modulation.

FIG. **3** represents in a diagram a data transmission device **20** according to the present invention, the structure of which is very similar to that of the device in FIG. **2**. The device **20** contains the antenna circuit **10**, the microprocessor **2** powered by the voltage VDD, the oscillator **3** delivering a signal S1 at 13.56 MHz, and the modulation switch **4** connected to the terminals of the coil **11** by means of the insulation capacitor **14**. The microprocessor **2** comprises binary ports P1 to P7 that can be set to "1" (voltage VDD), to "0" (output of the port to the ground) or to high impedance state. Finally, the microprocessor **2** is equipped with a memory **21** which contains, in particular, data DTa that are to be sent by modulating the amplitude of the antenna signal Sa, and the microprocessor operating system OS.

According to the present invention, the electric power supply of the antenna circuit **10** is provided by several microprocessor ports connected in parallel, here the ports P1, P2, P3, P4. The ports P1 to P4 deliver a power supply signal Sp which is the combination of signals Sp1, Sp2, Sp3, Sp4 delivered by each of the ports, and which is applied to the antenna circuit **10** by means of the inductor **13** and the capacitor **14** described above. The inductor **13**, or "shock" inductor, protects the ports P1 to P4 from overvoltages and the capacitor **14** insulates the coil **11** from the direct current. Here, the modulation switch **4** is controlled by the signal S1 and does not receive an amplitude modulation signal delivered by the microprocessor, as was the case in previous practices.

According to the method of the present invention, the four ports P1 to P4 are maintained on state "1" (voltage VDD present on the ports) to supply the antenna circuit **10** at full power level. The amplitude of the antenna signal Sa is modulated by modulating the amplitude of the power supply signal Sp itself, and the amplitude of the power supply signal Sp is modulated by changing the state of all or part of the ports P1 to P4.

Before describing this aspect of the present invention in further detail, it is reminded in relation with FIG. **4** that one microprocessor port Pi generally comprises a non-zero internal resistor Ri and can be shown in a simplified manner by an electric feeder comprising two switches Sw**1**, Sw**2** and the resistor Ri in series. The switch Sw**1** allows the output of the port Pi to be set to the power supply voltage V_{DD} (logic "1") or to the ground (logic "0"). The switch Sw**2** allows the switch Sw**1** to be disconnected to set the output of the port Pi to the high impedance state HZ. The resistor Ri represents the internal resistor of the port Pi, and causes a voltage drop which is a function of the current delivered by the port.

As a concrete example, FIG. **5** represents the logic diagram of a port P_{MT} of the microprocessor PIC16C6X marketed by the company Microchip Technology™ Inc., used by the applicant to assess the present invention. The port P_{MT} comprises two latches DL and TL controlled by means of the data bus DBUS of the microprocessor, and by port write WRP and port high impedance setting WRT signals. The output of the port is sampled at the midpoint of two output transistors PMOS and NMOS in series, powered by the voltage V_{DD} and controlled by the outputs Q or /Q of the latches DL, TL. Here, the internal resistor Ri of the port is the transistor PMOS resistor when it is in a transmission state (port output to 1).

Therefore, with reference to FIG. **3**, the modulation of the antenna signal Sa is obtained by setting all the ports **P1** to **P4** to 0 or by setting certain ports to high impedance while the other ports are maintained on 1. In the first case, the power supply signal Sp is zero and the amplitude of the antenna signal Sa is modulated at 100% (standard ISO/A). In the second case, a more substantial current passes through the ports maintained on 1 and their internal resistor Ri causes the voltage of the power supply signal Sp to drop without cancelling it, such that the amplitude modulation of the antenna signal Sa is less than 100%.

In practice, the number of ports to be set to high impedance depends on the modulation depth sought and the electric properties of the ports used. With the microprocessor PIC16C6X powered by a voltage V_{DD} of 5V, and an antenna circuit **10** that has a typical impedance in the order of 250Ω at 13.56 MHz, tests conducted by the applicant have shown that three out of four ports must be set to high impedance to obtain an antenna signal Sa amplitude modulation in the order of 10%, in compliance with standard ISO/B. More particularly, when the ports **P1** to **P4** are on "1" the current passing through each port is in the order of 5 mA, which represents an antenna current in the order of 20 mA. The voltage applied to the antenna circuit is in the order of 4.775 V. When three out of four ports are set to high impedance, such as the ports **P2** to **P4** for example, with the port **P1** being maintained on 1, the current passing through the port **P1** is in the order of 15 mA and the voltage applied to the antenna circuit is in the order of 4.3 V, i.e. an amplitude modulation of the antenna signal Sa in the order of 10%.

Thus, the device **20** in FIG. **3** has the advantage of being able to meet the standards ISO/A and ISO/B depending on the way in which the ports **P1** to **P4** are controlled, while being particularly simple in structure.

For a better understanding, the timing diagrams in FIGS. **6**A to **6**G show the control protocol of ports **P1** to **P4** for a data transmission according to the standard ISO/A, and the timing diagrams in FIGS. **7**A to **7**G show the control protocol of ports **P1** to **P4** for a data transmission according to the standard ISO/B. FIGS. **6**A, **7**A represent the logic signal DTa to be transmitted, constituted by a sequence of bits the values of which are only given as an example. FIGS. **6**B to **6**E, **7**B to **7**E represent the signals Sp1 to Sp4. FIGS. **6**F, **7**F represent the signal Sp. Finally, the aspect of the magnetic field FLD given off by the antenna coil **5** is shown in FIGS. **6**G, **7**G. On the timing diagrams in FIGS. **6**B to **6**F, 7B to 7F, the high impedance state is represented by a fictitious logic level HZ.

On FIGS. **6**A to **6**G, it can be seen that the magnetic field FLD is given off at full power level during the transmission of a bit to 1, the signal Sp being in the order of 5V. A bit to 0 is coded by a short pulse to 0 of the signal Sp, obtained by simultaneously setting ports **P1** to **P4** to 0 (signals Sp**1** to Sp**4** to 0). One pulse to 0 of the signal Sp causes a short interruption in the magnetic field FLD given off by the antenna coil **5** (100% modulation).

On FIGS. **7**A to **7**G, the magnetic field FLD is also given off at full power level during the transmission of a bit to 1. On the other hand, a bit to 0 is coded by a 10% amplitude modulation of the signal Sp throughout the time T of the bit (coding NRZ), T being the binary period of the signal DTa. The 10% modulation is ensured by maintaining the port **P1** on 1 and by setting ports **P2**, **P3**, **P4** to high impedance (signals Sp**2**, Sp**3**, Sp**4** in the state HZ). The 10% modulation of the signal Sp causes a 10% modulation of the magnetic field FLD, since the signal Sp is the power supply signal of the antenna circuit **10**.

It will be understood that the numerical values and combinations of controls described above are only examples. Those skilled in the art should implement the invention with more or less ports, depending on the features of the microprocessor used, the modulation rate sought and the impedance of the antenna circuit. If necessary, a single port may prove to be sufficient to achieve a device that only conforms to standard ISO/A, provided that the port can deliver sufficient current to achieve the maximum emission power of the magnetic field, which is defined by the application considered and the communication distance required.

Furthermore, although an example of an embodiment of the present invention was described above using a commercial microprocessor, any type of control circuit providing the above-mentioned features can be used to achieve the present invention. In particular, the present invention can be implemented by means of a specific integrated circuit of "ASIC" type ("Assigned Specific Integrated Circuit"). This specific integrated circuit can include a microprocessor or a programmable logic circuit comprising "port" type switch lines with a structure that is equivalent to that of a microprocessor port. In this case, the microprocessor ports dedicated to the antenna signal modulation, or the "port" type switch lines, can be connected inside the specific integrated circuit, such that the specific circuit only has one output contact stud to control the antenna circuit.

Second aspect of the present invention: embodiment of a circuit for receiving a signal transmitted by inductive coupling.

According to another aspect of the present invention, the ports of a microprocessor are also used to achieve, in a simple manner, an active filtering system used to receive data sent by integrated circuits using several communication protocols, particularly protocols ISO/A and ISO/B.

FIG. **8** represents an inductive coupling data send/receive device **30** that uses this aspect of the present invention. The device **30** comprises the same elements as the device **20** in FIG. **3**, described by the same references, and data receiving means which will be described below. The purpose of these receiving means is to extract a charge modulation signal from the antenna signal Sa that is sent by a contactless integrated circuit **40**.

This integrated circuit **40**, represented in a diagram in FIG. **8**, comprises an antenna circuit **41** and a charge modulation system. The antenna circuit **41** comprises an antenna coil **42** and a capacitor **43** in parallel. The charge modulation system comprises for example a switch **44** and a resistor **45** in series connected to the terminals of the coil **42**. The switch **44** is controlled by a modulation signal Sx delivered by an encoding circuit **46**, which receives data DTx at input to be transmitted. When the coils **11** and **42** are sufficiently close, the signal Sx is passed on by inductive coupling in the coil **11** to form a component of the antenna signal Sa. The signal Sx comprises, in a classical manner, an alternative or sub-carrier component of a frequency of 847 KHz and must be extracted from the signal Sa and demodulated before being decoded by the microprocessor **2** or by any other appropriate decoding means.

According to the present invention, the receiving means comprise a band-pass filter **31** set to a frequency of 847 KHz and a low-pass filter **32** with a cut-off frequency of 847 KHz. Here, the band-pass filter **31** comprises an inductor, a capacitor, a resistor and a diode in parallel, and the low-pass filter **32** comprises a resistor and a capacitor in parallel. Each filter **31, 32** is connected by one of its ends to a port of the microprocessor **2**, respectively **P5** and **P6**. The other end of the filters **31, 32** is connected to a common node **33-1**. The node **33-1** is connected to the output of an amplifying element **33** that is here in the form of a transistor FET having its drain connected to the node **33-1** and its source connected to the ground. The node **33-1** is also connected to a port **P7** of the microprocessor by means of an amplifier **33-2** and a signal transformation device **33-3** of "trigger" or differential amplifier type. The antenna coil **11**, through which the antenna signal Sa passes, is connected to a half-wave rectifier **34** the output of which is applied to a low-pass filter **35** having a cut-off frequency in the order of one Megahertz so as to remove any component at 13.56 MHz. The output of the filter **35** is applied to the input of the amplifying element **33** (here the gate of the transistor FET) by means of a capacitor **36** and a pull-down resistor **37**.

Therefore, the amplifying element **33** receives the charge modulation signal Sx at input, which is extracted from the antenna signal Sa by the low-pass filter **35**. When the ports **P5**, **P6** are at high impedance, the filters **31**, **32** are disconnected (in open circuit) and the node **33-1** is at high impedance. When a port **P5**, **P6** is set to 1 while the other port is maintained at high impedance, the corresponding filter **31, 32** is switched on and the envelope of the signal Sx can be extracted, by removing the sub-carrier. The envelope of the signal Sx is sent to the port **P7** of the microprocessor to be decoded, after being amplified by the amplifier **33-2** and transformed by the trigger **333**.

The device **30** according to the present invention has the advantage of being simple while enabling data to be received that have been sent according to various transmission protocols, the function of the ports **P6** and **P7** being to switch the filters **31, 32** while providing their electric power supply. For example, the microprocessor **2** selects and activates the low-pass filter **32** by setting the port **P6** to "1" when the signal Sx is a sub-carrier of a frequency of 847 KHz coded Manchester (standard ISO/A). The microprocessor **2** selects and activates the band-pass filter **31** when the signal Sx is a sub-carrier of 847 KHz coded BPSK ("Binary Phase Shift Keying"), i.e. by phase jumps (standard ISO/B).

Generally speaking, the low-pass filter **32** allows the frequency of any type of signal Sx to be demodulated if the frequency thereof is lower or equal to 847 KHz, including when the signal Sx is a binary signal without sub-carrier. The band-pass filter **31** is more particularly dedicated to the phase demodulation of the signal Sx when it is coded BPSK and has a frequency of 847 KHz.

It will be understood that other filters can be provided and connected to other ports of the microprocessor. Moreover, the frequencies of 13.56 MHz and of 847 KHz have only been given as examples described by the draft standard ISO 14443-2.

Generally speaking, the two aspects of the present invention are independent of each other. However, their juxtaposition enables multi-purpose contactless integrated circuit readers to be achieved at a low cost price, the final object of the present invention being to encourage and promote the use of contactless integrated circuits in "general public" applications such as electronic purses, telephone cards, electronic transport tickets, object identification (electronic labels), access control (electronic badges).

What is claimed is:

1. Method for modulating the amplitude of the antenna signal of an inductive antenna circuit comprising a coil, by means of a control circuit comprising binary ports that can be set to high impedance state and with a non-zero internal resistor, characterised in that the antenna circuit is electrically powered by at least two ports of the control circuit, and in that it comprises steps of:

setting the ports providing the electric supply of the antenna circuit to "1", to supply the antenna circuit at full power level, and

changing the state of at least one of the ports providing the electric supply of the antenna circuit, to modulate the amplitude of the antenna signal.

2. Method according to claim **1**, in which the ports providing the electric power supply of the antenna circuit are set to "0", for 100% modulation of the antenna signal.

3. Method according to claim **1**, in which at least one port is set to high impedance state while the other port or ports are maintained on "1", for a modulation of the antenna signal amplitude of less than 100%.

4. Method according to claim **1**, in which the antenna is also modulated in frequency by switch means connected to the terminals of the coil and controlled by an alternative signal.

5. Inductive coupling data sending device, comprising an inductive-type antenna circuit comprising a coil through which an antenna signal passes, a control circuit of the antenna circuit comprising binary ports that can be set to high impedance and with a non-zero internal resistor, characterised in that the antenna circuit is electrically powered by at least two control circuit ports and in that the control circuit is arranged to modulate the amplitude of the antenna signal in compliance with the method of claim **1**.

6. Device according to claim **5**, comprising an oscillator delivering an alternative signal, and switch means controlled by the alternative signal arranged at the terminals of the antenna coil to modulate the frequency of the antenna signal.

7. Device according to claim **5**, comprising a band-pass filter and a low-pass filter arranged to receive a charge modulation signal present in the antenna signal on a first terminal, and each connected by their other terminal to a port of the control circuit.

8. Device according to claim **7**, in which the control circuit is arranged to select one of the filters by setting the port connected to the filter to be selected to "1", and by setting the port connected to the other filter to high impedance state.

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UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

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